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CARS

THEIR CONSTRUCTION, HANDLING AND SUPERVISION

IN TWO BOOKS

BOOK I—THE RAILWAY CAR, ITS CONSTRUCTION AND HANDLING

BOOK II—THE CAR SERVICE DEPARTMENT

THIS VOLUME EXPLAINS AND ILLUSTRATES BY DRAWINGS, ETC. THE METHODS OF CONSTRUCTION OF FREIGHT AND PASSENGER CARS AND THEIR PRINCIPAL APPURTENANCES: ALSO HOW CARS ARE HANDLED. IT DESCRIBES THE MANNER IN WHICH THOSE CONNECTED WITH THE CAR DEPARTMENT OF RAILWAYS ATTEND TO THE DISTRIBUTION AND CARE OF CARS, AND HOW THEIR MAINTENANCE AND REPAIR ARE LOOKED AFTER.

FORMING ONE OF THE SERIES OF VOLUMES COMPRISED IN THE REVISED AND ENLARGED EDITION OF

THE SCIENCE OF RAILWAYS

BY

MARSHALL M. KIRKMAN

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BOOK I.

THE RAILWAY CAR, ITS CONSTRUCTION AND HANDLING.

INTRODUCTION.

As usually understood in Railway parlance in America, the term "Cars" denotes the vehicles used by railways in the conduct of their business of transportation.

Broadly speaking, Railway Cars may be divided into three classes:

(1) Those used in Freight Service.
(2) Those used in Passenger Service.
(3) Those used by a Railway for its own purposes in such work as construction, or the maintenance of its property.

A distinction in terms, is, however, sometimes made in designating these several classes. The vehicle used in the conduct of freight traffic is a "car;" that used in the conduct of passenger business a "coach;" and that used by the railroad for its own purposes a "work car." *

Frequently the cars of a railroad are referred to as its equipment, but this may be said to be a careless use of the term, as the equipment of a railroad not only embraces its cars, but also all other necessary and equally important adjuncts of its business—such as its locomotives, shops, stations, yards, bridges, etc.

In the freight, passenger and work departments of the railroad service, the kinds of cars used are, necessarily, classified in detail. The following broad classification might be greatly amplified, but will serve to indicate the variety in use:

* In England freight vehicles are known as "waggons," "trucks" or "vans," according to the particular uses to which they are put; passenger vehicles are designated "carriages."

FREIGHT CARS

Caboose or Way	Box	Drovers' Caboose
Furniture	Flat	Barrel
Gondola	Carriage	Drop Bottom Gondola
Hopper	Hay	Refrigerator
Lumber	Fruit	Stock
Ice	Double Deck Stock	Milk
Ore	Poultry	Coal
Tank	Coke	

PASSENGER CARS.

Baggage	Express	Mail
Smoker	Buffet	Combination
Observation	Dining	Parlor
State Room	Coach, 1st Class	Chair
Tourist	Coach, 2d Class	Sleeping
Private		

BUSINESS AND WORK CARS

Officers' Business	Pay	Air Brake Instruction
Dynamometer	Inspection	Supply
Ballast	Gravel	Ditching
Boarding	Ballast Spreader	Steam Derricks
Wrecking	Tool	Pile Driver
Excavator	Snow Plow	

It will be readily understood, from this limited classification, that the purposes conserved by the car equipment of a railway are many and varied and that it represents a department in railway operation equal in importance to any. Hence, the construction, maintenance and handling of cars requires a distinct department in the organization of railways and has become a science, demanding as much thought, attention and skill as any other great department, whether it be that of construction of roadway, maintenance of track, operation of motive power, acquisition of traffic, or administration of finance and accounts.

The author takes pleasure in acknowledging that in the preparation of this volume he has received the advice, assistance and co-operation of Mr. W. H. Dunham, mechanical engineer, and other experts in matters connected with the construction and practical handling of railway cars.

CHAPTER I.

THE DEVELOPMENT OF THE AMERICAN FREIGHT CAR.

The history of American car construction is a long record of evolution. Beginning with only the experience of wagon and coach makers as a guide, the railroad men having to do with car construction have gradually perfected each detail which enters into the completed modern car. They have taken up each requirement as it appeared and have admirably met the needs of transportation. As a consequence we now have, instead of the open flat or gondola car of the early railroad days, special freight cars for handling stock, bulk freight, furniture, carriages, liquids, barrels, ore, dairy produce, dressed meats, fruits, ordnance, etc. Also instead of the stage coach like car we now have in passenger service the sumptuous coach, chair car, parlor car, sleeping car, and private car together with special dining cars, buffet cars, smoking and observation cars. The barest necessities required in the caring for passengers are now superseded by the most modern luxuries. Comfortable cushioned seats, sanitary ventilation, carpeted floors, evenly distributed heating, brilliant lighting, continuous vestibuled trains and practically all the comforts and accommodations of home life are furnished for the railway traveler.

The first recorded use in this country of cars on railroads for carrying passengers was on the

Baltimore & Ohio Railroad in 1830. In that year the first fifteen miles of that system had been completed to Ellicot's Mills. The cars used were adaptations of the Conestoga wagons which were common in that territory as freight wagons for transporting over the highways the large amount of goods and produce which was then being handled at Baltimore as a market. The long wagon box like body was constructed with high sides, the driver's seat being located across the front and the facilities for entering at the rear. A cover was placed over the part assigned to the passengers. This was fitted between the posts with loosely draped curtains for protection. Some of the cars were constructed strong enough to carry passengers on the roof when the weather permitted.

Each of the cars in the brigade, as it was called, was drawn by two horses. They made in regular service, what was for that time, the remarkable speed of twelve miles an hour.

It is generally admitted that the original regular service of a complete passenger train with a steam engine as the motive power was on the Mohawk & Hudson Railroad between Albany and Schenectady, N. Y., in 1831. This railroad now is a part of the New York Central & Hudson River Railroad. The cars were similar in design to the old stage coach with its outside and inside seats. There was the space for luggage both on top and under the outside seats at each end. The simple lever brake which answered for the highway was also used as was the method of suspending the body on long strap springs. The precedent for this practice was found in England

where coaches of this same type had already been in use. Indeed the modern English railway coach is still built on the plan of separate coach like compartments with the doors for each at the sides of the car. In order to make larger cars two or more coach bodies were joined together and so framed as to form a single car. At first only two pairs of wheels were used under these long cars. Later, as an improvement, double trucks were introduced, each truck having four wheels.

An early departure from the coach design was made when a short four-wheeled rectangular car was built. This car was carried by semi-elliptical springs resting on the journal boxes which were outside of the wheels instead of inside as had been the custom with most four-wheel cars. End doors and short platforms were provided but there were no steps and the draft rigging had no spring attachment of any sort. The gabled and shingled roof, small rectangular windows and sheathing running lengthwise of the body were evidently copied from house construction and gave the car the appearance of a small shed placed on wheels. The interior was of the most severely plain finish, the walls being simply painted. The two hard bench like seats extended lengthwise of the car, one on each side. However, these cars were short lived.

About 1835 there appeared the long car built somewhat on the lines of the modern passenger car. The body of the car was rectangular in construction and it was carried on two four wheeled wooden trucks. The sides of the car were panelled, being framed between the window

rails and the sills, but no truss rods were used. The short platforms were greatly improved by the addition of steps and hoods. Double cross seats were arranged on one side of the car, the opposite side having the old long bench extending from end to end. All the windows were stationary. Ventilation, however, was obtained through panels, between the windows, which could be raised or lowered. The interior of the car was finished in plain beaded siding which was painted a light drab. The outside was painted yellow. This particular car was thirty-two feet long over the end sills, thirty-seven feet long over the platform timbers and eight and one-half feet wide over the side sills. The trucks had a wheel base of four feet and nine inches while the spoked wheels were thirty-three inches in diameter. The body bolster was of wood as was also the entire truck frame. Wooden brake shoes also were used.

With this car as an origin there has been change after change in small details and large until the present construction of passenger cars has resulted. Wooden trussing of the sills was succeeded by iron truss rods, over-hanging wooden platforms have been replaced by steel or vestibuled platforms, single reversible seats replaced the double benches placed back to back. Thus improvements have been made for comfort, convenience and strength.

As early as 1836-37 efforts were made to furnish sleeping accommodations for passengers while en route. The Cumberland Valley Railroad fitted up a passenger car with berths. The car was divided into four sections each of which had

three berths, upper, middle and lower. Although crude in its construction this car was kept in service until 1848 when it was abandoned. Various other means were devised to furnish sleeping quarters. But with them all there were no bed clothes supplied. The coarse mattress and pillow did not appeal to the traveler. These efforts resulted solely in supplying a means of resting which indeed was more comfortable than sitting on the straight hard benches all night. In 1859 George M. Pullman experimented with some day coaches of the Chicago & Alton Railroad, converting them into sleeping cars. The cars, as changed, were a decided improvement over past efforts to meet the wants of the public. They were very well received and were kept regularly in service. In 1864 Mr. Pullman built, at the shops of this same company, the sleeping car "Pioneer" which was the first car built on the lines of present sleeping cars. It was a foot wider than previous cars and two and a half feet higher. As a consequence several of the bridges and all of the station platforms had to be altered before the car could be run over the road. A raised deck and an improved truck were also among the changes in design which were introduced. As completed this car became the standard as to height and width for future Pullman sleepers.

Parlor cars for daylight travel naturally followed the solution of the sleeping car problem. These added materially to the comfort and luxury of travel as they were fitted up solely to meet these requirements. Together with the sleepers they were soon considerd as a necessary equipment of first-class trains.

Another step of the car building and car operating company, which had been organized by Mr. Pullman, was the introduction of the "hotel" car "President" in 1867. Arrangements were made for placing portable tables between the seats of a sleeping car, one end of which was partitioned off as a kitchen and pantry. In 1868 a complete car devoted solely to the furnishing of meals, the "Delmonico," was put into regular service.

During all these general changes made in passenger cars, minute and careful study was made of the various details entering into their construction. Baggage, express, mail and even horse cars were constructed to be handled in trains running as fast or faster than those carrying passengers. The railway mail service which was conceived in 1864 and has increased every year, takes for its exclusive use no small part of the railway companies' equipment. These cars have to be especially constructed to meet the requirements of the government and at the same time they are elaborately fitted up with everything which will assist in the work of distributing the mail while the trains are in motion.

The various investigations of the problem as to how to successfully heat these trains resulted in the setting aside first of the stove and then the independent system of hot water heating as utilized with the Baker heater and the final adoption of steam from the locomotive as the heat generating medium. Practically all of the passenger cars used in sections of the country which have cool weather are now equipped with continuous steam pipes under the cars which connect to radiators inside. These radiators are arranged

to heat the car directly or by auxiliary hot water circulation.*

The closed or vestibuled train was an early study. In 1852 patents were issued for a canvas covering to connect adjoining cars and form a covered passageway between them. These covers were used on the Naugatuck Railroad in Connecticut, but were abandoned about 1861 after nearly four years' trial. In 1887 the narrow vestibule, which enclosed only the landing between the steps, was brought out. This was followed by the standard or wide vestibule which extends the full width of the car and has drop doors over the steps to make the platform level all the way across the car.

In the early days the tallow candle held in a sort of lantern and suspended at each end of the car was the only method of illumination. Oil lamps and gas and electric lights are now the general means of lighting according to the location of the railway and the character of its train service. Improvements in each of these systems have been and are still constantly being made. Where it is possible to reach a charging station, the gas lamp, supplied from storage reservoirs under the car, is much better and safer light than the oil lamp. The gas systems have been reduced now to practically two types, that using Pintsch gas and that using acetylene gas. Electric lighting of trains is also of two types: first, that in which a dynamo is operated in one, generally the baggage, car for lighting all the cars in the train. With this system, when a car

*The subjects of lighting and heating passenger trains are treated in another volume relating to trains.

is detached from the train it has to be lighted by some other means. The second system is that in which a dynamo is geared or belted to a truck axle on each car. While the car is in motion sufficient current is generated to illuminate the lamps and also charge a storage battery which is called upon to supply current for the lamps when the car is at rest.

The introduction of the power brake on passenger trains required the use of some sort of coupler which would leave no slack between the cars, but at the same time the cars should have relative motion vertically without loosening the coupling. This necessity brought out the Miller platform, consisting of the spring buffer and vertical plane coupler or "hook" as it was commonly termed. With the introduction of the automatic coupler of the Janney type for freight cars the Miller "hook" has been superseded by the former coupler. The general idea of the buffer, however, has been retained on all types of continuous platforms.

In 1827 a railroad was built between Boston and Quincy. It was a crude affair, and was constructed for the purpose of handling granite for use in the Bunker Hill monument. This was one of the first places where cars on rails were used for transporting freight. The cars were of the plainest and simplest type, being very much like the heaviest styles of push or "dollie" cars now used by railroads. They were hauled by horses. The wheels were entirely outside the body, the axles being arranged for inside journals. About 1829 the Carbondale Railroad was opened by the Delaware and Hudson Canal Company between

the head of their canal at Honesdale, Pennsylvania, and the mines at Carbondale, a distance of sixteen miles. The cars were pulled partly by stationary steam engines and partly by horses. This was also the first place where a steam locomotive was used to handle the freight trains, the initial trip of the engine being made in August, 1829.

As an improvement over the heavy "dollie" car of the Boston and Quincy Railroad cars were constructed of lighter material. They were widened by placing the journals outside the wheels and letting the wheels project up into the framing of the car, but not far enough to disturb the flooring. Sides were fitted to the car; at first they were shallow, but gradually higher ones were used until the gondola car was evolved. This car also was originally designed to be hauled by horses. A step toward the modern type of double trucked eight wheeled car was the use of two of these light four wheeled cars without the sides under a special framework made to carry firewood. This framework rested on bolsters through which king bolts attached it to the cars. This same manner of using two cars for long loads was also used on the Boston and Quincy Railroad. Almost all improvements in freight equipment of railroads have been along such lines; adaptations to the local and immediate conditions and requirements. It was but a simple change from the double car to a regularly designed car having special trucks and with the draft rigging attached directly to the car body. The necessity for a more permanent covering than could be obtained with tarpaulins brought

out the construction of a framework over the simple flat car. Thus we have the beginning of the American Box Car.

Until 1848 there was very little change made in the designs and construction of freight cars. They had increased to about ten tons capacity, the dead weight being nearly as high. The roofs were sometimes covered with duck that was painted and sanded. Draw bars of the link and pin type with spring attachment had then come into general use. However, it was not until almost 1880 that any move was made to increase the generally adopted standard capacity (ten tons) of the cars. And this in spite of the fact that there was a great demand for larger and stronger cars capable of taking greater loads. Even the Master Car Builders' Association in 1877 deprecated the idea of building cars for carrying more than ten tons of freight. Nevertheless the demand for larger cars increased. As a consequence the standard was gradually increased, the cars being strengthened for taking fifteen, then twenty and twenty-five tons of lading until the thirty ton car was developed about 1888 for general service with approximately the proportion of the modern car. It must be noted that with all the advances in the carrying capacity of the freight car there was no material departure from the original form of construction as used on the old standard ten ton car of 1848. The rule of thumb method of design and construction had remained in force and continued to do so for some time afterward. Notable examples of the results of this method of construction were the many large capacity cars which

did not hold up, but sagged down in the center and also onto the side bearings. This created a prejudice against these large cars which was very nearly fatal to their adoption. The cars were hard to handle on the road and were continually breaking down. However, about this time more accurate attention was paid to the proper proportioning of the various parts to stand up properly under their particular strains. This technical study of the car building problem gradually improved the situation and paved the way for larger cars of either part steel or all steel construction for carrying forty, fifty and even fifty-five tons of lading each. The introduction of steel into the car body was gradual. Until the Columbian Exposition in 1893 at Chicago there was no real attempt made to develop its use. A steel car had been built in 1890, but it did not in itself create favorable impressions. Nevertheless it opened the way for the use of steel for many parts of the car. Up to 1897 there were no definite attempts made to adopt the all steel car. In that year the Pittsburg, Bessemer & Lake Erie Railroad ordered a number of 100,000 pound capacity, all steel, gondola cars. It is said that the success of this undertaking created such a favorable impression that the construction of some nineteen thousand steel cars occurred within the next two years.

In a somewhat similar manner the original forms and designs of the car trucks have been developed into the modern details. Under the ten ton cars a wooden, square framed truck, built with as little metal as possible, answered all purposes. The advent of larger capacities first

pushed aside the wood frame and substituted the diamond arch bars. Channel irons soon superseded wood for transoms. The bolster was the last part in which wood was used. As a matter of fact wood is still in use in many bolsters. It is found in the various forms of the simple wooden beam, the trussed wooden beam and the flitch plate or built up type with steel plates inserted between wooden members. There is no marked period for any of these changes in truck construction. In a general way it may be said that the diamond frame was in general use in 1882 and that wood had practically disappeared from new construction in all parts of the frame excepting the bolster about 1895.

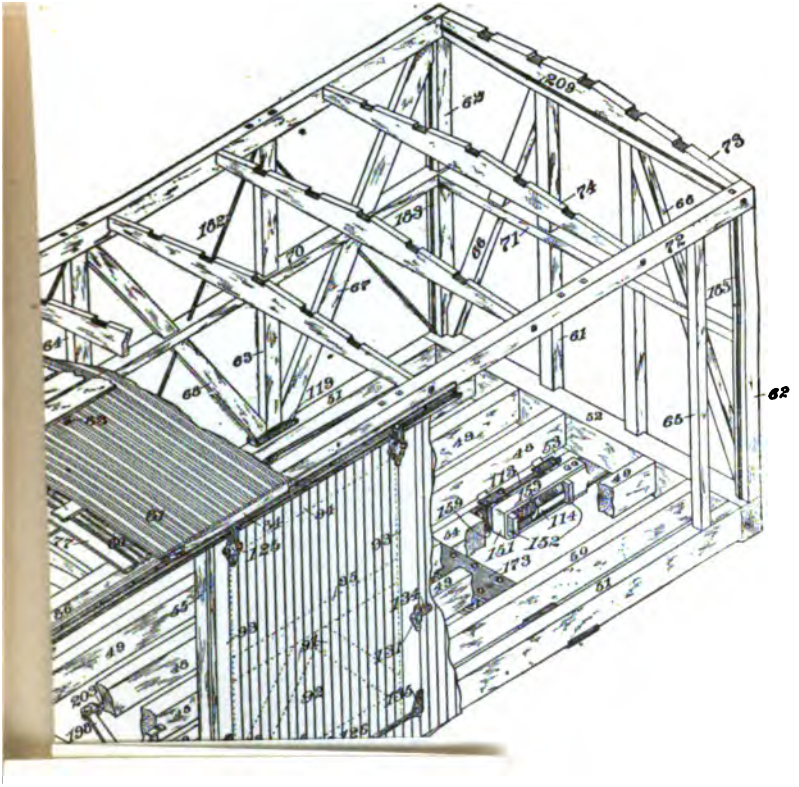
On account of the great number of fatal accidents to train crews and switching crews, it was early noted that improvements in the link and pin form of drawbar were needed. Several years of investigation and study by the Master Car Builders' Association—an organization of the officers of railroads who are in charge of the construction and repairs of cars—culminated in 1887 in the adoption, as a standard, of the vertical plane automatic coupler of the Janney type. The use of this type was later made mandatory by the Government as was also the vertical height of the center line of the draw bar above the rail. These regulations now apply to passenger cars and locomotives as well.

Schemes for the braking of cars for years afforded a fertile field for the inventor. Many ideas were worked out which had for their principal object the application of the retarding force to the rail. On account of the slowness of action and the

tendency to cause derailments these forms were entirely abandoned. Various methods have been developed for applying the brake shoes to the circumference of the wheels. The earliest forms consisted of a simple metal bar with a wooden shoe or a plain wooden stick which was so arranged as a lever that pressure could be applied directly to the wheel tread. Improvements over this resulted in the use of brake beams with wooden shoes, which were operated by hand through a lever or a hand wheel. In the early eighties there was an evident need for power brakes. Various types of buffer, momentum, steam, air, electric, and vacuum brakes were devised. None of them had been tried out in freight service although a few had been used on passenger cars. In order to determine what each type could do and also to find out the exact requirements of a power brake for long freight train service, a series of tests were made on the Chicago, Burlington & Quincy Railroad under the auspices of the Master Car Builders' Association in 1887. As a result of these tests and supplementary ones in the following year it was demonstrated that the quick action, automatic air brake was the best type for freight service. To-day this is a standard portion of the equipment of all new cars. It has also been applied to most old cars. In fact the Government regulations now require that at least fifty per cent. of the cars in a train shall be equipped wit' air brakes in working order and that they shall all be set in the train so that the brakes will be under the control of the engineer.

In the construction of cars these are problems

to be met by the designer that are peculiar to the individual railroad. The physical characteristics of the road are often the limiting features. A road that has many tunnels, a large number of which are comparatively small in section, will have to build its cars to suit these conditions. In order to make the best use of all the space available the car body itself will be made to just clear the limiting obstructions. All projecting attachments will be made as short as possible. Even narrow platforms will be provided at the ends of the freight cars for the brakeman's use when the train is passing through the tunnels. The eaves of the passenger cars will be very low and the clear-story will be quite high when the size of the oval shape tunnel prevents the use of a more generous car section. The total length and width of cars is often limited on mountain roads by the sharp curves and projections on the inside of the curve. This is especially the situation with passenger equipment, in the building of which there is a marked tendency to lengthen out the cars. Sometimes the maximum allowable wheel loading will prevent the use of cars of large capacity. It is thus that the car builder is often hemmed in by many obstacles in his efforts to supply the demands for cars, and the peculiar appearance of the cars he builds is often due to the necessities of the case. A design or practice that is eminently suited to the conditions of a given locality will very often not answer the purpose at all at another place. Thus the progressive Master Car Builder will continue to bring out a special design of car as each new requirement of the service makes it advisable to prepare special equipment.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equipment

CHAPTER II.

THE UNDERFRAMING—SILLS—BODY BOLSTER—CROSS FRAME TIES—TRUSS RODS AND FLOORING.

Sills.—In the construction of a car the first part that is put together is the under framing. This is true of any sort of car, flat, gondola, box or special. The structure upon which the car depends is the rectangular frame work of the longitudinal sills, and the end sills, body bolster and center cross-tie timbers. These various parts are indicated on Plate I., which illustrates a standard Box Car. Center sills No. 48: Inside Intermediate sills No. 49: Outside Intermediate sills No. 50: Side sills No. 51; End sills No. 52; Center cross ties No. 58 and Body Bolster, the component parts of which are indicated by numbers 116, 117, 173, 174.

Of the main longitudinal sills there are always four, the two center and the two side sills; sometimes six, when two intermediate sills are used, and frequently with high capacity cars, eight when two more intermediate sills are added. With the cross-tie timber or "Needle Beams" and the body bolster on the under side, and bolted to each sill, and the end sills framed to each longitudinal sill to which they are held by the truss rods (No. 149 Plate-I) which pass through the end sills over the body bolster and under the cross-tie timbers, a construction is obtained which can be used as a car itself, or a super-structure

can be added to make of it one of the many special sorts of cars needed by a railroad.

The longitudinal sills are of Long Leaf Southern Yellow Pine. Carefully inspected pieces only are used for these timbers, the importance of which is self evident. The end sills and cross-center ties are of White Oak, only solid pieces of wood being used. In the selection of the sizes of timber to be used a great deal is dependent upon experience and standard practice. It is very desirable if consistent to have all the long sills in a car of the same cross section, and this practice is usually followed when a car has a super-structure which can be depended upon to assist in carrying the load. The sills vary in general between a section of 4½″ x 8″ to a section of 5″ x 9″. Sometimes the intermediate sills are lighter, the dimension adopted depending upon the strength desired, the kind of car being constructed and the requirements of the particular service for which it was designed. In passenger cars this is more frequently the case than with freight cars. However, in the construction of flat cars the side sills will ordinarily be increased in depth. This is done to get a longer bearing for the stakes which are often used to hold the load on the car, and also to stiffen the sides of the car so that it can withstand the shocks due to sliding heavy and concentrated loads onto the car. As this kind of car has no upper framing to help support the load, the sill must be made of ample section to stand it alone. Gondola cars also are sometimes built with the side sills of greater depth than the remainder of the longitudinal sills.

The Master Car Builders' Association has adopted as a standard the following finished sizes for sections of longitudinal sills. In doing so it expressed the belief that the standard afforded sufficient range of sizes to cover all requirements of design:

For cars such as Box, Stock, Flat, Gondola, Refrigerator, etc., 32 feet and over in length, but under 40 feet:

4 "x8"	4 "x9"	4 "x10"	4½"x12"	5"x14"
4½"x8"	4½"x9"	4½"x10"	5 "x12"	
5 "x8"	5 "x9"	5 "x10"		

For cars 40 feet long and over, such as furniture and special long gondola:

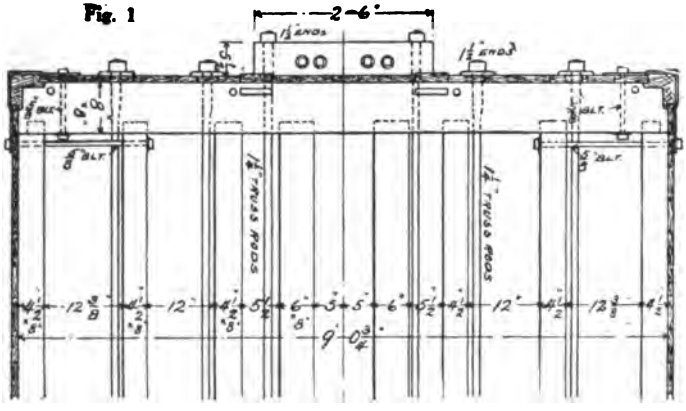
4½"x8"	4½"x9"	5"x10"	6"x12"	6"x14"
5 "x8"	5 "x9"	6"x10"		
	6 "x9"			

The longitudinal sills are framed with tenons into the end sills, the whole structure being held in place as mentioned before by the truss rod. Figure 1 shows the general method of framing and securing the end sills of cars without end platforms.

As a means of protecting the framing of the corners of the car, corner plates of either pressed steel or malleable iron are used (Plate I, No. 168). They are usually the full depth of the sill and extend far enough from the corner each way to get good support for the retaining bolts. They are fastened at both ends with ½" or ⅝" bolts, one in each corner. Sometimes the outside truss rods hold them to the end sills, a cast iron filling block being used around the rod and be-

tween the corner plate and sill. This block is used because the soft wood of the sheathing is not strong enough to stand the pressure under the truss rod nut. At times a pocket or cavity is formed on this corner plate to make a convenient place for resting the push pole, often used in moving the car by an engine on the adjoining track. This has sometimes given it the name of push pole plate. Similar (Plate 1, No. 169-170)

Fig. 1



METHOD OF FRAMING AND FASTENING END SILLS.

plates or bands, but narrower, are used upon the super-structure to strengthen the corner framing of the girths and plates.

Body Bolster.—These are sometimes called Transoms, Body Transoms or Cross Bearers. They are the cross beams over the trucks near the ends of the cars, by means of which the weight of the car structure and its lading is transmitted to the center plates around which the trucks

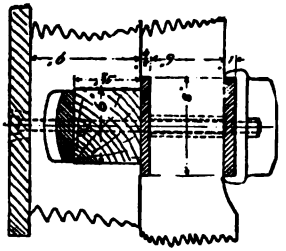
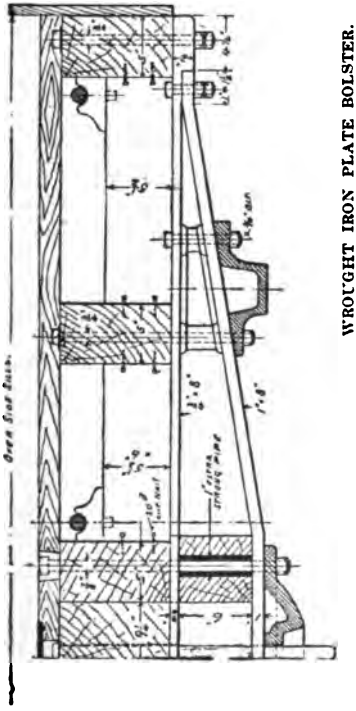


Fig. 2



WROUGHT IRON PLATE BOLSTER.

swivel. They are the main support of the car. Upon the strength of the bolster depends the success of the car design. On account of the limited space and varying conditions with each car, there has been no general standard of construction used. Each case has to be decided for itself and consequently there are numerous types and forms of bolsters in common use. They all are either

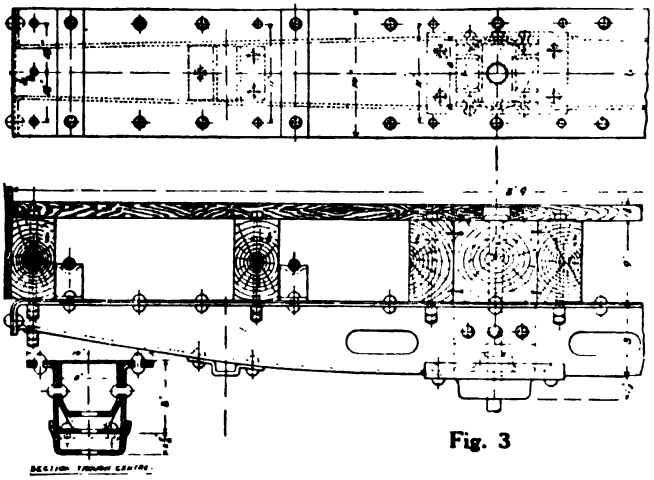
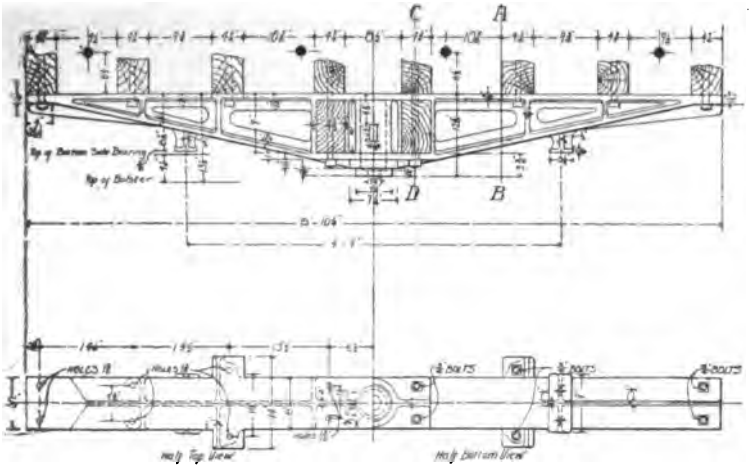


Fig. 3

PRESSED STEEL BODY BOLSTER.

iron or steel in the built up or solid form. Figure 2 illustrates a common form of bolster built of two wrought iron plates with cast iron filling pieces between them over the side bearing. Another filling casting is also usually inserted between them in the space between the draft timbers which project through them. This form of bolster is also shown on Plate 1, where



CAST STEEL BOLSTER.

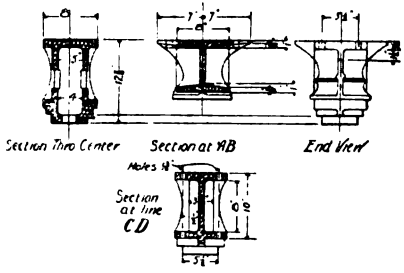
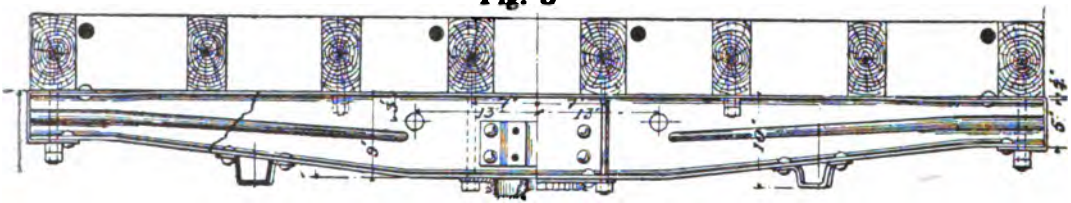


Fig. 4

Fig. 5

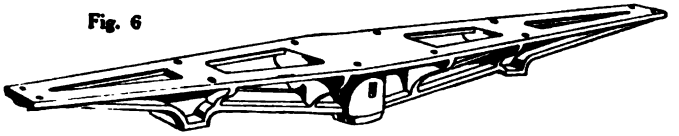


BETTERDORF I BEAM BODY BOLSTER.

No. 173 is the top or tension plate and No. 174 is the bottom or compression plate. Whatever the design or material of the bolster, it is always bolted to all the sills with usually two bolts to each sill.

Another form of bolster is shown in Figure 3.

Fig. 6



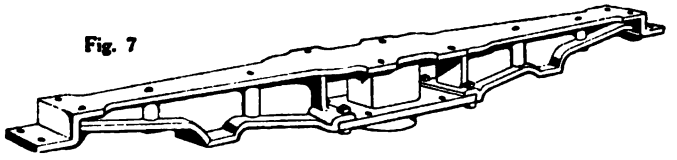
COMMONWEALTH BODY BOLSTER.

This is made up of steel plates pressed into the desired shapes and riveted together. Its detail needs no explanation.

Figure 4 showing a cast steel bolster is also very clear as to its construction.

Figure 5 illustrates the Betterdorf I Beam Bolster. These are made of two I Beams which are

Fig. 7

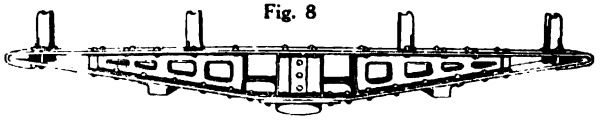


COMMONWEALTH SEPARABLE BODY BOLSTER.

bound together in a parallel position by bands riveted to the flanges at each end and at the center. The Beams themselves as shown are shaped by off-setting the web at each end so that the vertical depth is less than at the center where the full shape of the I Beam is preserved.

The illustrations Figures 6, 7, 8, 9, and 10 show some of the bolsters of the types already indicated which are in general use. The Commonwealth bolsters are of the cast steel type, while the Simplex bolsters are of the built up or plate type. The Williamson-Pries bolster is also of the built up type, the filling pieces of which are both cast or malleable iron and rolled Z bar.

Fig. 8



SIMPLEX BODY BOLSTER.

Cross Frame Tie Timbers.—Cross frame tie timbers (Plate 1, No. 58) or needle beams are the transverse beams under the sills between the body bolster. Their purpose is to tie the sills together, preserving the spacing and also to act

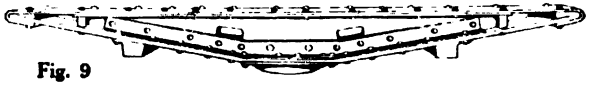


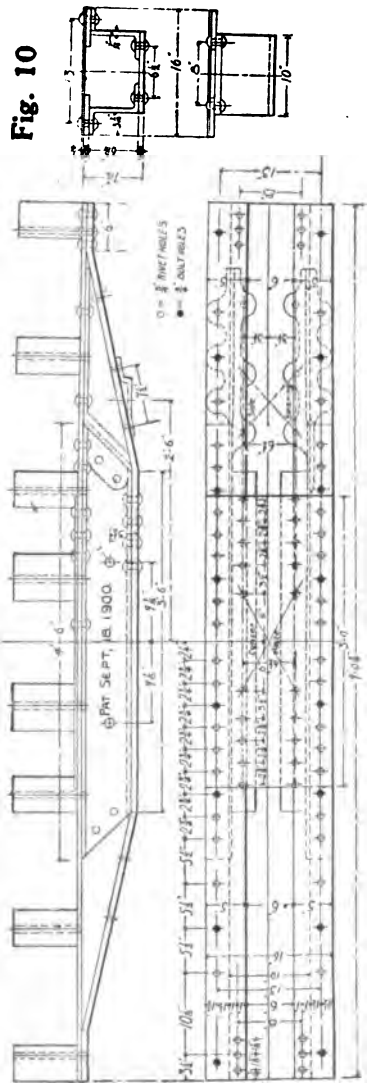
Fig. 9

SIMPLEX BODY BOLSTER.

as supports for the truss rod bearings. They assist materially in stiffening the sills to which they are bolted. The top of the cross tie timber is usually gained for a depth of ½ inch for each of the sills, thus forming a shoulder on each side of the center and intermediate sills, and for the inside of the side sills.

Truss Rods.—The truss rods (Plate 1, No. 149) are used for the purpose of overcoming the

Fig. 10



WILLIAMSON-PRIES BODY BOLSTER.

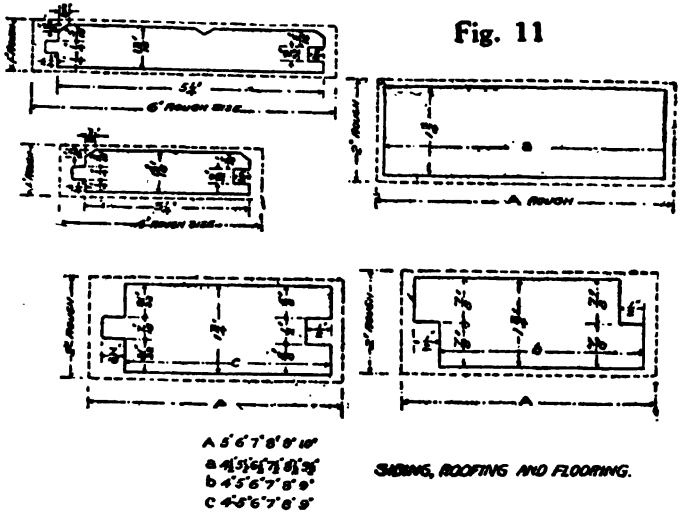
deflection of the longitudinal sills when the car is loaded. On flat cars reverse truss rods are also used, an example of this construction being shown on Plate VI. These are added to give the same rigidity to this class of car that is given the other kinds by the super-structure.

The number of rods and their strength will depend upon the load to be carried and also on the kind of car. Flat and Gondola cars will need proportionally more support from this source than the various forms of Box or Stock cars, as the former lacks the support afforded by the side framing of the latter. The trussing is secured by passing the rods through the end sills, over bearings on the body bolster, and under bearings on the cross tie timbers. The bearings, saddles or king posts (Plate 1, No. 110) are usually made deep enough to raise the rod nearly to the flooring. As illustrated in Figure 2 a block is often secured between the sills on top of the body bolster, and the bearing then rests on top of this blocking. Figure 8 shows deeper saddles which are secured directly to the body bolster. For the same reason that a deeper saddle gives a better truss, the queen posts (Plate I, No. 111) on the cross tie timbers are made as deep as possible. Between the queen posts at the center of the car, turnbuckles (Plate I, No. 150) are located. After the rod is in place and the end nuts drawn down so that the rod just projects through them, the turnbuckles are turned up to set the rod in place. Later when the framing is all completed the turnbuckles are drawn up more. Usually they are tightened enough to give the sills about one inch camber. A block (Plate 1, No.

106) or key is then passed through the opening in the turnbuckles. This is secured from dropping out by keys through it.

Sometimes the diameter over the threads at the ends of each half of a complete rod is the same as the body of the rod. The usual practice, however, is to make this diameter about one quarter

Fig. 11



MASTER CAR BUILDERS' STANDARD SIDING, ROOFING AND FLOORING.

of an inch longer. The threads for the nuts are all right handed, half of those for the turnbuckles are also right handed the other half being left handed. The threads are cut to the United States Standard for the different sizes of rods. This is true also of all other rods as well as bolts.

Flooring.—After the under framing is erected the flooring is laid. This is usually all of pine,

either Norway or Southern. With box cars, however, the floor boards at the door way are sometimes of oak. The general practice is to use shiplapped flooring, 1¾ inches to 2¼ inches thick, the thicker material being used more especially on stock and flat cars. The shiplapped boards are used because of the ease with which a broken or worn out board can be replaced. In fact a tongued and grooved floor on a freight car is a very rare thing at the present date. The Boards are usually laid cross-wise of the car and are spiked to each sill. Special arrangements, however, are made for individual classes of cars, and all kinds of cars which have inclined floors for assisting in unloading the lading, usually have the flooring laid so that the load will slide along the grain of the wood, as this helps materially in the handling of the commodity.

The Master Car Builders' Association in 1901 adopted as standard the following specification. "Flooring shall be of three kinds: square edged, dressed all over, shiplapped, or tongued and grooved, dressed all over, in accordance with the section shown." This is illustrated in Figure 11.

CHAPTER III.

THE FREIGHT CAR SUPERSTRUCTURE—FRAMING—SHEATHING—ROOFING—RUNNING BOARDS—ATTACHMENTS AND DOORS.

Framing.—The framing of freight cars above the sills is very much the same for all classes with the exception of the open topped types, such as Gondola cars. The most common type of enclosed car is the box car, and a treatise of its general design will outline the methods used for all styles.

The frame work consists of the posts (Plate I, Nos. 55, 61, 62, 63, 64 and 65), Braces (Plate I, Nos. 66, 67, 68, and 69), Side Plates (Plate I, No. 72), End Plates (Plate I, No. 73), Carlines (Plate I, No. 74), Purlines (Plate I, No. 76), Ridge Pole (Plate I, No. 75) and Girths (Plate I, Nos. 70 and 71). These when all properly secured in place form the framing to which the covering peculiar to the kind of car being built is secured. The plates, connected together in the form of a rectangle having the same outside dimensions as the side and end sill construction, are elevated on the posts. These are either framed directly into the plates and the sills with mortises and tenons or are set into metal pockets which are framed into the plates and sills by means of round or rectangular projections. The whole structure is then tied together with framing rods. Braces, placed

in the panels to preserve the vertical position of the frame, are framed to fit their respective locations without tenons, or any special fastening other than, at times, the metal pockets such as are also used for the post (Plate I, No. 119). They are held in place by the sheathing on the outside and the lining and flooring on the inside. The heavy thrust of the braces on the top of the side door posts is guarded against by fitting a strip between the door posts and nailing it to the underside of the plate. The thrust on the corner posts is taken up by the upper corner plate and a strap bolt secured to the side plate and passing through the end plate. One or more girths or nailing strips are secured to the posts and braces with nails or screws. Carlines, placed at proper intervals, extend from side plate to side plate and support the purlines and ridge pole to which the roof is secured.

There are varied styles adopted in the construction of frames, though none of them involves principles different from those indicated. The variations in arrangement are due mostly to the experience of the designer and the facilities at hand for the construction and care of the car. The main desire is to distribute the material so as to form a truss lengthwise of the car to assist in carrying the load and at the same time have sufficient stiffness to resist the lateral pressure from the load.

Figure 12 shows a common form of side framing. Another form, in general use also, is shown in Figure 13. This illustrates the use of post and brace pockets which are also shown in the outline (Plate VIII) of a modern stock car.

The usual method of end framing employed is illustrated in Figure 14, the dimensions indicated of course being varied to suit the particular car.

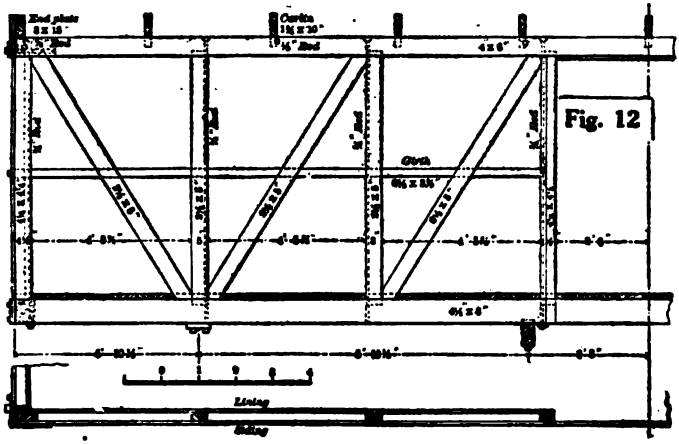


Fig. 12

ARRANGEMENT OF SIDE FRAMING.

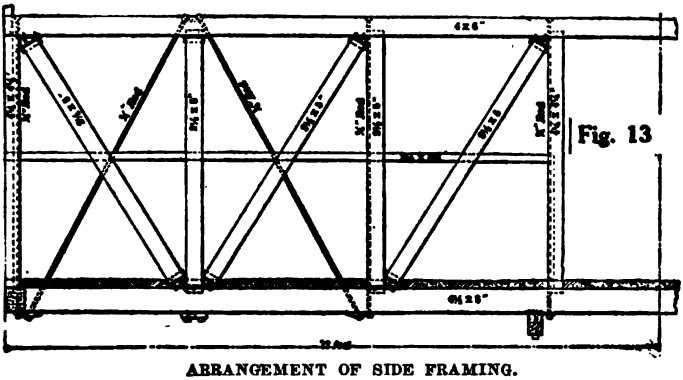


Fig. 13

ARRANGEMENT OF SIDE FRAMING.

When the car does not have an end door or when the door is located at the side next to the

corner post, the end framing shown in Figure 15 is sometimes used. This does not make as stiff a frame to withstand pressure from the inside

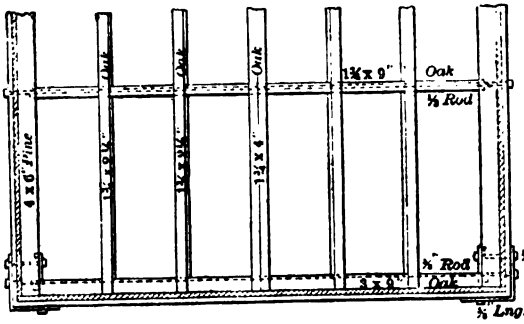
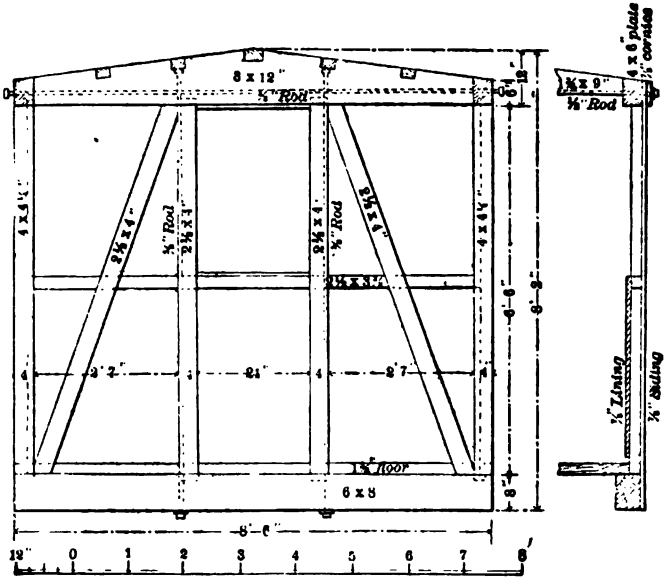


Fig. 14

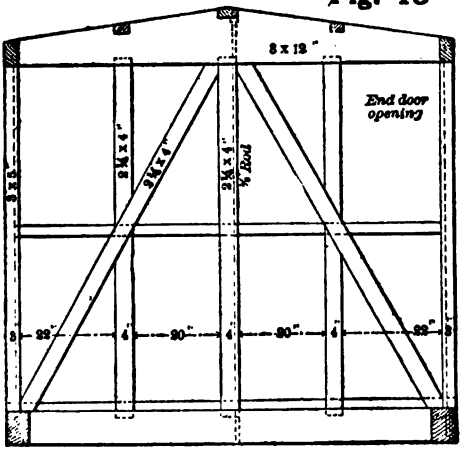


END FRAME CONSTRUCTION.

because there is only one full sectioned post instead of two, as in Figure 14. Naturally the stronger construction is in more general use both with and without end doors.

As a recommended practice the Master Car Builders' Association has adopted the styles of framing shown in Figure 16 for the sides and ends of cars with the capacities indicated.

Fig. 15

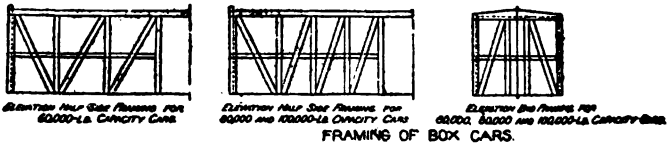


END FRAME CONSTRUCTION.

Posts.—The posts are designated as door posts (Plate I, No. 55), body posts, of which there are two kinds, the intermediate post (Plate I, No. 64) and the transom posts (Plate I, No. 63), corner posts (Plate I, No. 62), and end posts (Plate I, No. 61). The body posts are usually of white oak or long-leaf southern pine. As mentioned above they are made thick enough to stand the

outward thrust of the lading, 2½"x5" to 6" being the most common dimensions selected. The corner and door posts are almost always made of white oak. In sections they are more nearly square, the inside corner being gained out to receive the lining that is secured across the face of the intermediate posts. The sizes usually met with are from five to five and one-half inches square, although occasionally larger sections are used. The end posts are invariably made heavier than the body posts. The shifting of imperfectly loaded material causes such excessive strains on these posts that they are ordinarily made very

Fig. 16



FRAMING OF BOX CARS.

MASTER CAR BUILDERS' RECOMMENDED FRAMING.

deep. Instead of having the sheathing cover these posts they usually project out beyond it and thus gain in strength in the proper direction for stiffness. Of course the outside corners are then gained to form a place for securing the sheathing. This same method is frequently used also on all the other posts of the car, more often, however, with the door and corner posts. When extra precautions are desired, a band of flat iron is secured by bolts to the side of the post. This iron is then bent at right angles at both ends of the post and secured to the sill and plate by lag screws or bolts. The reinforcing construction makes a very

rigid and strong post, and one that will last under the severe strains of service much longer than the simple wooden post.

Braces.—Compression braces (Plate I, Nos. 66, 67, 68 and 69) are usually made of the same material as the body posts, white oak and southern pine being the most common woods used. They are ordinarily of the same thickness as the body posts but they never project, as the posts sometimes do, beyond the outside faces of the sills and plates. When the brace is to be subjected to a tensile strain it is made of iron, in the form of a strap or a long rod, and it is usually designated as a brace rod (Plate I, No. 182). Braces are called "Right-hand" or "Left-hand" according to the inclination of their top to a person facing the car.

Plates.—The side plates (Plate I, No. 72) are usually made of the same material as the sills with a thickness at least that of the posts. Usually the plate is slightly thicker. It is not less than five inches deep, with the top face beveled to suit the pitch of the roof. However, the top face is at times left square to suit the framing of the carlines. In that event a filling block is used on top of the plate, which is beveled to the roof pitch. On account of its small dimensions and because the roof boards are nailed to it, this block is made of oak.

The end plates (Plate I, No. 73) are of oak, but sometimes hard pine is substituted. At the ends where it is framed to the side plate by mortises to suit the double tenons on the side plate it has the same depth as the outside face of the side plate and filling block, if the latter is used.

The depth at the center is made to suit the roof pitch. It is gained out to receive the purlines and ridge pole as shown in Figure 14.

Carlines.—Carlines (Plate 1, No. 74) are almost invariably made of oak. However, there is a tendency to substitute metal for wood in this detail. In framing the carline it is usually made straight across on the under side, the top of course being tapered to the pitch of the roof. The material used is never less than 1⅝ inches thick and seldom more than 1⅞ inches. If more strength is required in the roof, more carlines are used in preference to making them any thicker. They are usually spaced about three feet from center to center.

There is a variety of ways and details for framing the carlines to the side plates. If the carline is shallow a single thick tenon is used; if the depth will allow it a double tenon is used. When a mortise and tenon joint is used some sort of tie is necessary; strap bolts (Plate I, No. 181) secured to the ends of the carline, passing through the plate and sheathing; a short rod running through the first purline and side plate; a framing rod (Plate I, No. 210) along side or underneath the carline extending through the plate and sheathing with the nuts exposed at both ends. These ties are usually placed on every other carline. A more simple framing of the carline is to lip the carline over the top of the plate which is left square or gained to receive the carline. It is then secured by screws to the plate with a framing rod at every other carline.

Purlines.—The purlines (Plate I, No. 76) are longitudinal rectangular pieces of timber, usually

oak, extending from one end plate to the other, into which they are gained as well as into the carlines. They are nailing strips as well as supports for the roof boards. Ordinarily they are not continuous pieces of wood, the joints being always made over a carline.

Ridge Pole.—The ridge pole (Plate I, No. 75) like the purline extends from one end plate to the other, and is gained into the plates and carlines. It is located at the peak or ridge of the roof and its top face is beveled to suit the roof pitch on each side of the car. It is usually about twice as wide as the purlines and is made in one continuous piece.

Girths.—The girths (Plate I, Nos. 70 and 71) are stiffening pieces for the framing as well as nailing strips for the sheathing. Sometimes they are called belt rails. They are usually made thick enough to fill the space between the sheathing and lining and extend from ⅞″ to 1″ inside of the posts and braces. When made of a solid piece of wood it is gained out to receive all the posts and braces. A much better construction is to use approximately square filling blocks and nailing strips which extend between braces and posts at the proper location and then use a board as the girth about 1¼″x6″ across the inside faces of the posts and braces. This girth is secured to each post and brace by screws as well as to the blocks, and is usually made of oak. For cars of ordinary size a single girth is all that is required but frequently two are used.

Sheathing.—The sheathing (Plate I, No. 88) of a car is the covering placed on the side outside of the frame work. The material used is generally

dressed and matched boards of best quality white pine, however the particular kind of lumber used is governed by considerations of cost. It is essential that it should be well seasoned or kiln dried, otherwise the natural shrinkage will be so great that the car will soon cease to be weather-proof.

As a rule the boards are surfaced on both sides to a thickness of from ¾ to ⅞ inches, they are tongued and grooved and are beaded on the outside face, a "V" groove being sometimes used. They are applied with vertical joints and nailed securely to the plates, braces, girths and sills. The number of nails to each board depends on the width of the board, steel wire nails being preferred to cut nails. Usually one nail is driven blind at each nailing place.

Lining.—The inside sheathing is called lining (Plate I, No. 89). It is run lengthwise of the car on the sides and across the car at the ends. In quality it is "second" or "common" grade of white pine or any suitable lumber, matched and grooved. This lining does not extend to the floor but is usually raised at least 1¼" above it by spacing blocks which are nailed close to the floor at each post. At the end of the car it extends up to the plate. At the floor and against the outside sheathing is secured a triangular piece of lumber called the "grain strip" (Plate I, No. 105). This is of such dimensions that all grain which might get in behind the lining will be thrown out from under the lining onto the floor where it can be readily reached when unloading the car. If necessary, additional provision is made for letting out the grain where the post and braces come together at the floor line. A hole is simply cut through the

bottom board of the lining. This triangular grain strip and the opening in the lining is also used above the girths where the lining extends to the plate at the ends of the car, and above the lower girth when two are used on the sides with the lining extending up to the second.

The Master Car Builders' Association has adopted as a standard that the section of siding or sheathing and lining shall be as shown in Figure 11. These figures are closely adhered to for the sheathing and side lining. However, for the end lining there is a tendency to use thicker material. For this purpose the Master Car Builders' Association has recommended the use of 1¾ inch planking.

Roofing.—The difficulties of car roofing are great and all of them can not yet be said to have been overcome. A car roof should be (a) impervious to the elements; (b) safe and easy to walk over and not liable to injury on this account; (c) of such construction that the shocks and vibrations incident to the service will not impair its efficiency, and (d) economical in first cost and maintenance.

There are in use four general styles of roof construction: (1) The double board roof; (2) the single board roof covered with tin or other sheet metal; (3) the sheet metal roof protected by a single layer of roughly matched boards; (4) a type of double roof consisting of an inside roof covered with felt, tar paper or asphalted canvas and an outside roof built over it to protect the roofing material from injury.

The double board roof is perhaps the most used. In the construction of this roof only the best

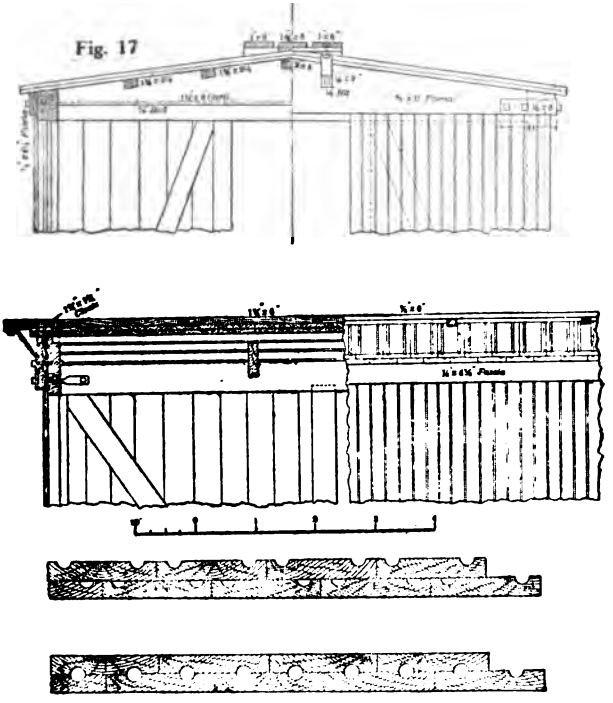
seasoned white pine boards should be used. A common practice is to use boards dressed on both sides and edges to a uniform size of about ⅞x5½ inches and have two semi-circular grooves of ⅝ inch diameter on one side, near each edge. The purpose of these grooves in the top course of boards is to catch and carry off as much of the water as possible, keeping it out of the joints; these same grooves in the under course catch and carry off such of the water as penetrates the joints of the top course. As the grooves in the under course are apt to become clogged with dirt sometimes the two grooved sides are placed in contact so as to increase the size of the channel for carrying off the water. The boards of both courses are nailed to the plates, purlines and ridge pole. Wooden screws are sometimes used in place of nails but they are expensive and troublesome. The edges and faces of the boards are always heavily coated with paint before they are laid. The pitch of the roof varies from 1¼ to 2 inches rise per foot. The steeper the pitch the better the protective qualities of the roof but the more dangerous to the trainmen who have to pass over it. The construction of a double board roof is shown in Figure 17.

This same form of roof is also made up of the tongued and grooved boards as shown in Figure 11, which illustrates the standard Master Car Builder's roofing. This tongue and grooved board is sometimes grooved on its face, the upper boards only being treated in this manner.

The single board roof covered with tin or other sheet metal is slightly more costly than the double board roof. It is thought to be more effective in

shedding water than the double board, but has objectionable features. It is liable to injury through being walked on and the roof appliances such as running boards (Plate I, No. 82), grab irons (Plate I, No. 167) and brake rest (Plate I,

Fig. 17



DOUBLE BOARD ROOF.

No. 124) cannot be attached with such facility. They are also liable to wear holes in the tin by rubbing, etc. The general form of construction of the tin roof is shown in Figure 18.

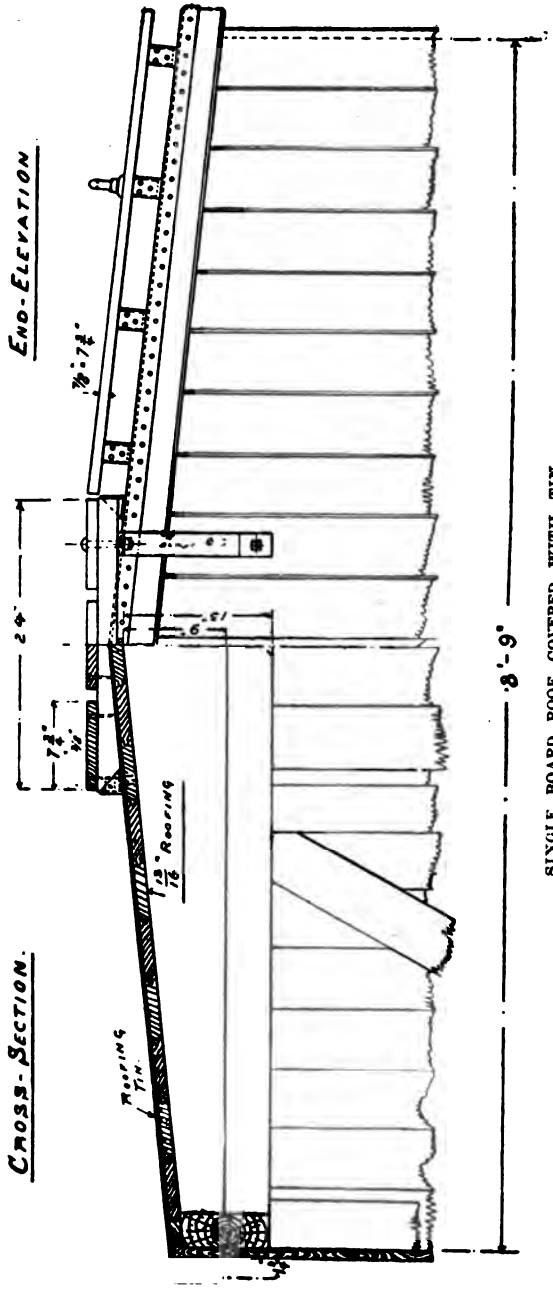


Fig. 18

SINGLE BOARD ROOF COVERED WITH TIN.

The single board and tin roof was the precursor of all the metal car roofs. The liability to injury led to the substitution of sheet iron or steel. The general method of construction of such roofs is indicated by Figures 19 and 20.

The sheet metal roof protected by boards is often used and various methods of construction have been adopted. The illustrations Figures 21 and 22 will indicate the general method of construction.

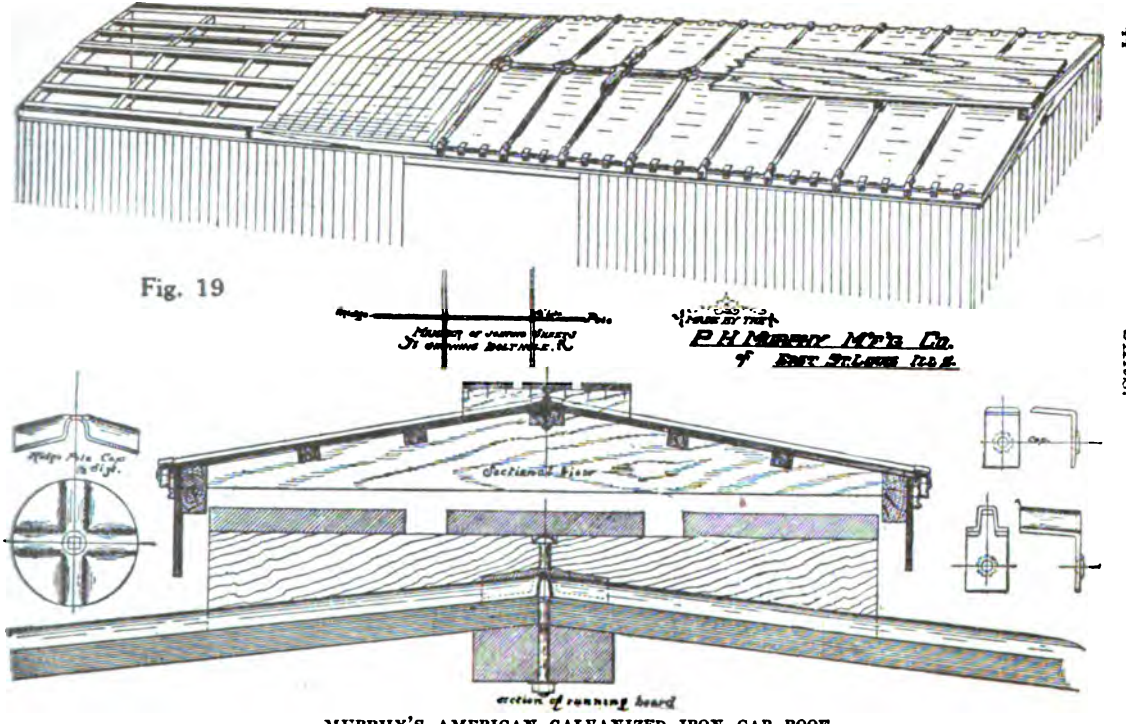
The type of double roof consisting of an inside roof covered with felt, tar paper or asphalted canvas and an outside roof built over it has found many exponents. Figures 23, 24 and 25 will serve to show the general methods adopted in the construction of such roofs.

The Master Car Builders' Rules provide that roofing shall be of the section shown on Figure 11, and the tongue and groove placed centrally so that either side of the material can be used as a face side.

Running Boards.—An important adjunct to the roof of a box car is the running board (Plate I, No. 82). It is the trainmen's means of passing over the train in their care.

The Master Car Builders' Rules provide, as shown in Figure 34, that: "The ends of the running boards of box cars be made to project over the ends of the cars, and properly supported, so that the end of the running board shall not be more than six inches back of the face of the buffer block. The running board shall be made not less than 18 inches wide."

The running board is usually made of three 1x6



MURPHY'S AMERICAN GALVANIZED IRON CAR ROOF.

THE

EXCELSIOR CAR ROOF

MANUFACTURED BY THE

EXCELSIOR CAR ROOF COMPANY,

ST. LOUIS MO.

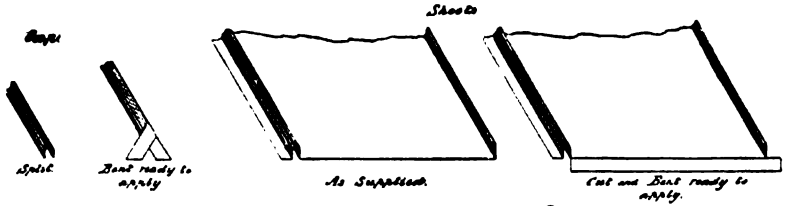
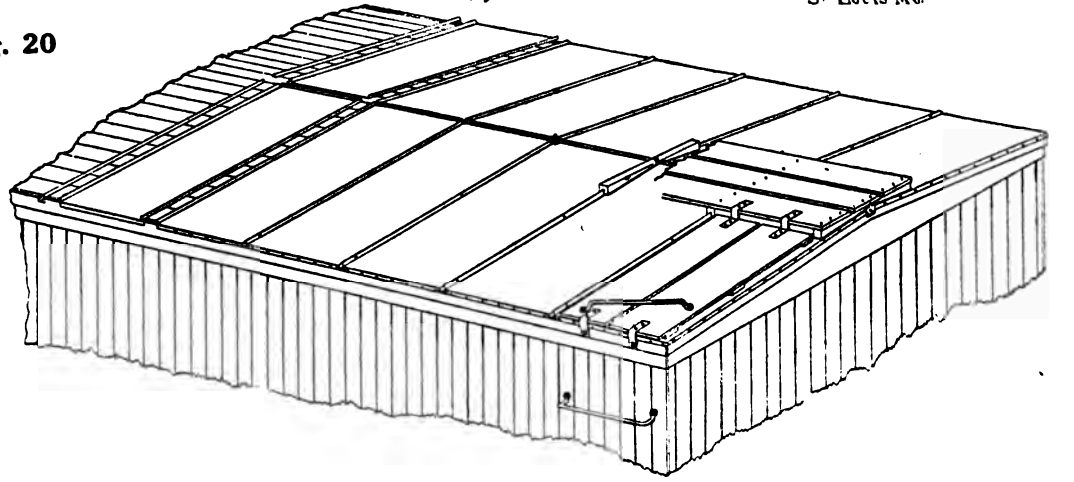
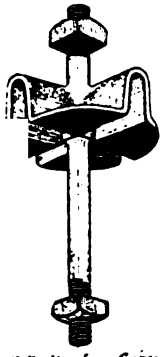


Fig. 20





inch strips supported on hardwood cleats at proper intervals, the whole construction being secured by screws. The extensions beyond the ends of the car are supported by wrought iron brack-

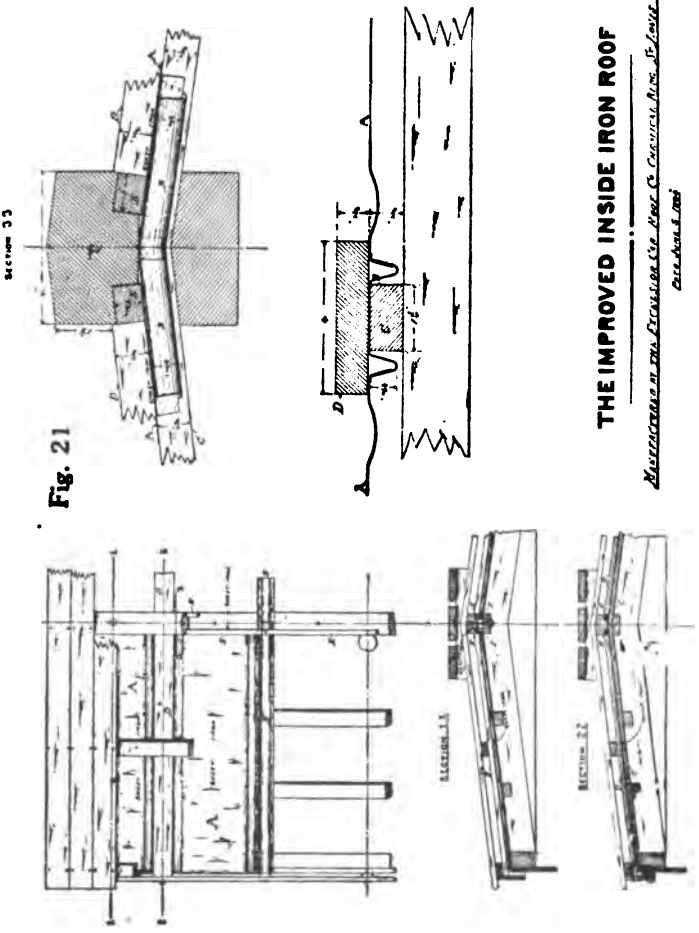


Fig. 21

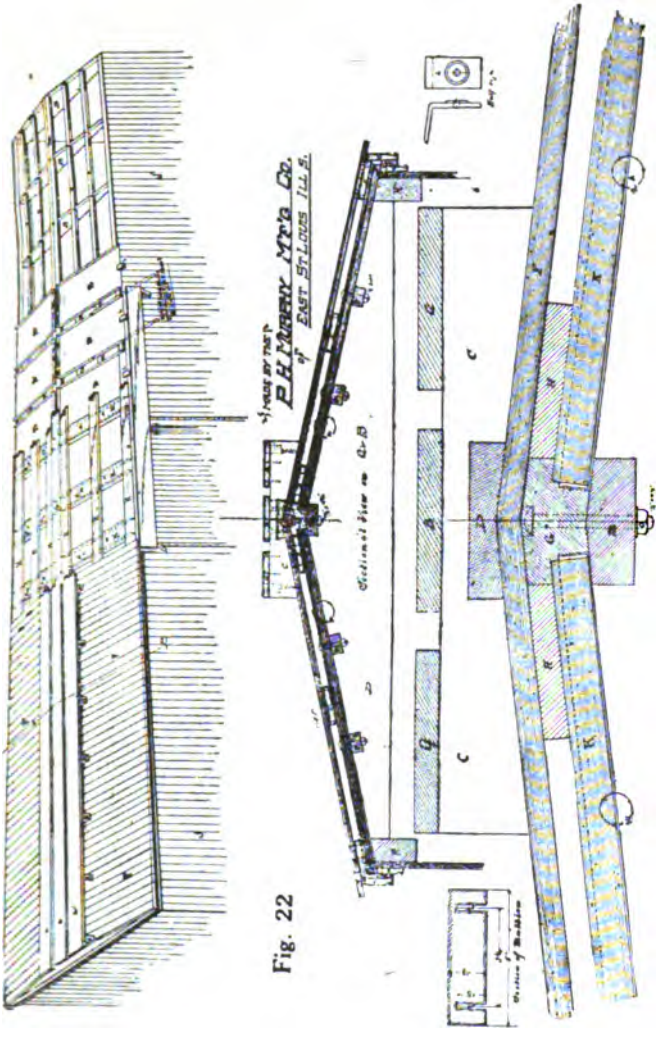


Fig. 22

IMPROVED WINSLOW CAR ROOF.

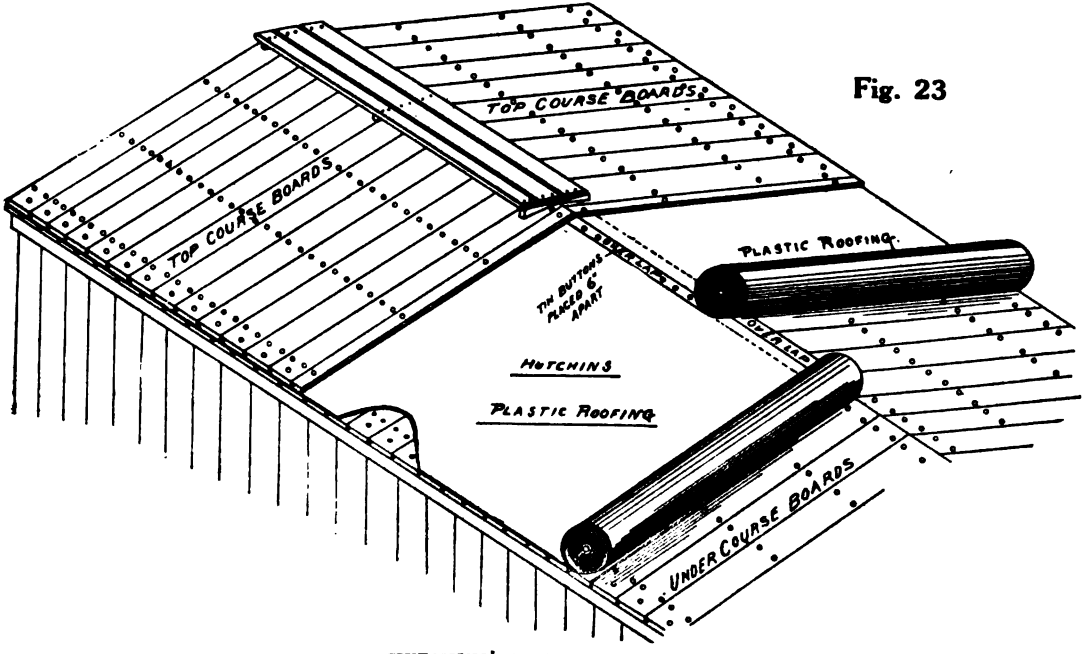


Fig. 23

HUTCHINS' FREIGHT CAR ROOF.

Fig. 24

The Torsion-Proof Car Roof
Patented

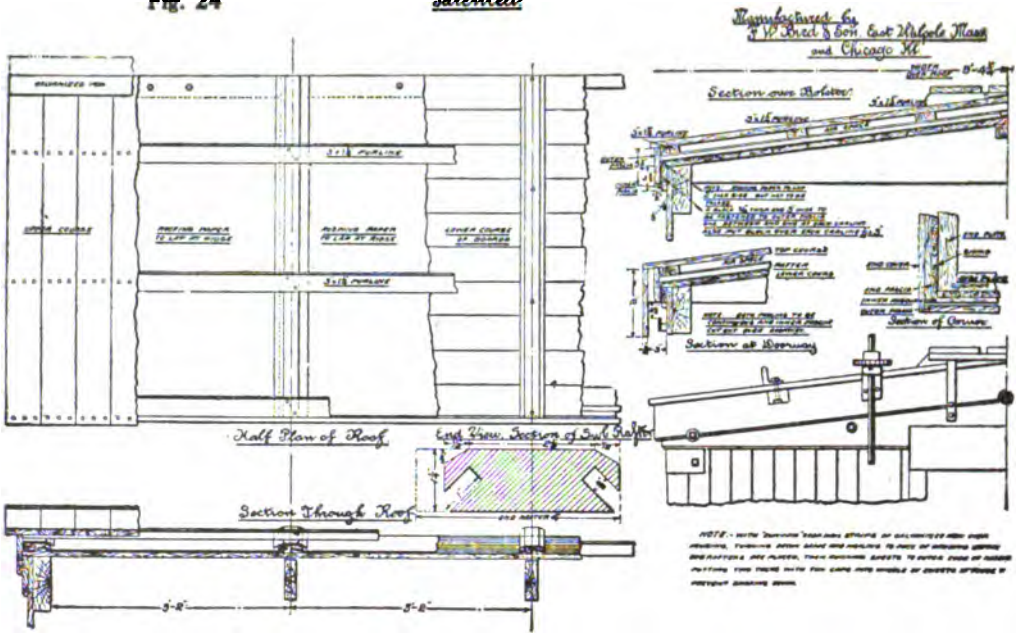
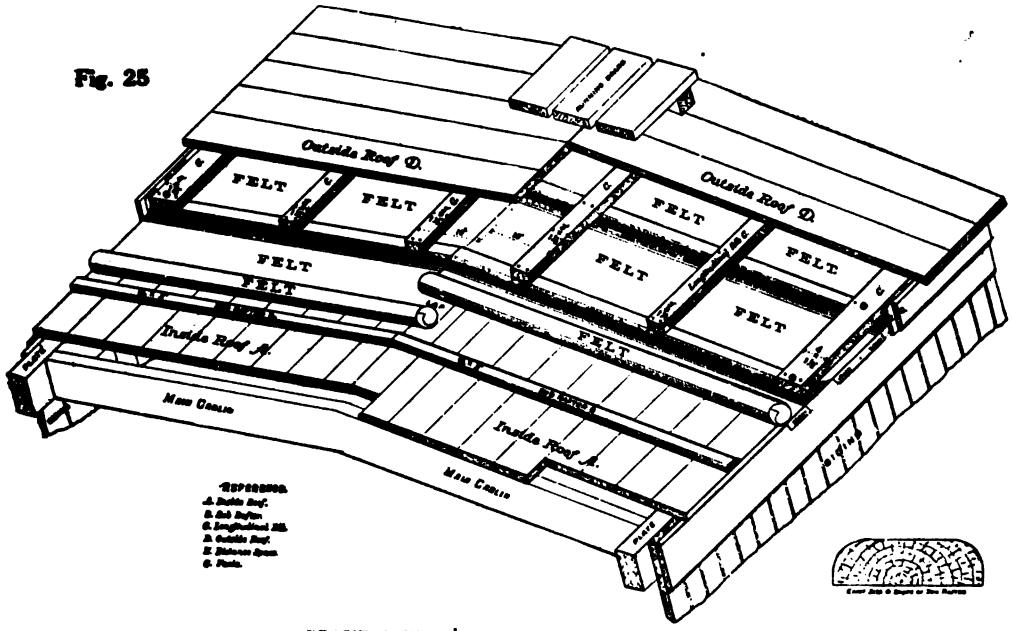


Fig. 25



DRAKE & WEIR'S ASPHALT CAR ROOFING.

ets and a cleat fastened with bolts and lagscrews. These brackets are shown in Figure 17.

When the boards are all of the same thickness, the cleats, which are placed over the carlines and plates, are shaped on the underside to fit the roof and on the top side to make a level place for the running boards. Sometimes the middle board is made thick and forms a cap for the peak of the roof. It is then gouged out to fit snugly over the roof boards. The boards at each side are then secured on short cleats. This form of running board is shown in Plate VIII.

Attachments for use of trainmen.—These consist principally of steps, handholds and grabirons (Plate I, No. 165, 166, 167).

A standing resolution of The American Railway Association provides that: "Each box and stock car should have two iron or wooden ladders, with not less than five steps to each ladder; the steps to be not less than 2½ inches from side or end of car; each ladder to have a handhold on the roof directly over the top of ladder. When iron ladders are used and placed on ends of car, the bottom step to have a guard or projection to prevent men from slipping when swinging around the end of car to get on the step.

"When the ladder is placed on the ends of a car a handhold should be placed on opposite side of the end of car from the ladder, and when ladder is on sides of car two such handles should be placed on each end of car about 24 inches above the bottom of the sill.

"On all freight cars which are not equipped with ladders (such as flat cars), two handholds should be attached to each end sill. Handholds

on end sills should have at least 2 inches clearance behind them, and all other handholds should have at least 2½ inches clearance behind them.

"All handholds should be made of iron not less than five-eighths inch in diameter. Handholds on sides and ends of cars should be at least two feet long in the clear; those on end sills to be made shorter only when it is impossible to use this length."

The number of ladder irons is usually five, made of ⅝-inch round bars, 20 inches long extending 3½ inches from the siding, and fastened with a ½x3½ inch lag screw at each end. The lower iron, if the ladder is on the end of the car, is shaped with an offset or projection. Sometimes, end ladders are made of side-pieces of 1¾x3½ inch hard wood, fastened to the frame of the car to which irons are bolted or inserted in holes as in the case of an ordinary ladder. Steps made of ½x1¾ inch flat or 1 inch round bar iron, with an opening of 10 inches extending 8 inches below the car body are placed at the corners corresponding with the ladders and are fastened with lag screws or bolts to the underside or face of the sill (Plate I, No. 176).

A handle or grabiron (Plate I, No. 167) is placed on the roof above the ladder usually from 12 to 15 inches from the edge of the roof. Handles are also placed on the ends of the car (Plate I, No. 165) so that those coupling the cars can use them should they lose their foothold.

The "Safety Appliance Act" of 1893 provides that "until otherwise ordered by the Interstate Commerce Commission it shall be unlawful for any railroad company to use any car in interstate

commerce that is not provided with secure grab irons or handholds in the ends and sides of each car for greater security to men in coupling and uncoupling cars."

The Master Car Builders' Rules in regard to steps, ladders and handholds are as follows:

"*Steps.*—Two good substantial steps, to be made of wrought iron, about ½x1½ inches section, to be fastened, one to each side sill, next to the corner of the car to which the ladder is attached, on cars having ladders, and to diagonally opposite corners on all other cars. The steps to be not less than 12 inches long, measured horizontally between the sides, and the tread to be not less than 8 inches below the bottom of the sill. The side of the step next to the corner of the car to be as near to the end of the car as is practicable. Each side of the step to be fastened to the sill with two ½-inch bolts and nuts.

"*Ladders.*—Each box and stock car should have two iron or wooden ladders with not less than five steps to each ladder; steps, if of iron, to be not less than ⅝-inch diameter; if of wood, to be not less than 1½x2 inches, and to be made of hardwood; the steps to be not less than 2½ inches from side or end of car; each ladder to have the handhold on the roof directly over the top of ladder, the handhold to run longitudinally with the car, and to be located about four inches from the side edge of the roof. When iron ladders are used and placed on ends of car, the bottom step to have a guard or projection to prevent men slipping when swinging around the end of car to get on the step.

"*Handholds.*—Box and stock cars constructed with projecting end sills with end ladders should be provided with a horizontal grabiron or handhold about 24 inches long on side of car over each step, located not less than 18 inches nor over 30 inches above center line of drawbar. The end ladder should be located on left-hand side on end of car and one horizontal grabiron or handhold, about 24 inches long, on right-hand side of end of car not less than 18 inches nor over 30 inches above center line of drawbar, the lower rung of ladder being a suitable grabiron for opposite side of end of car, as shown on Fig. 26.

"Box and stock cars constructed with projecting end sills with side ladders located over steps, the lower rung of such ladders is an effective grab. They should also be provided with two horizontal end grabirons or handholds, about 24 inches long, located on each side of end of car not less than 18

inches nor over 30 inches above the center line of draw-bar as shown on Figure 27.

"Box and stock cars not constructed with projecting end sills, and which have end ladders, should be provided with horizontal grabiron or handhold about 24 inches long on side of car over each step, located not less than 18 inches nor over 30 inches above the center line of drawbar. The end ladder should be located on left-hand side of end of car and one horizontal grabiron or handhold about 24 inches long on right-hand side of end of car not less than 18 inches nor over 30 inches above center line of drawbar, the lower rung of ladder being a suitable grab for that side of end of car, as shown on Figure 28. End ladders constructed without side frames should have the lower rung provided with a guard to prevent the foot from slipping off.

"On box and stock cars not constructed with projecting end sills, and which have side ladders located over steps, the lower rung of such ladder is an effective grab. They should

Fig. 26

END LADDER AND GRAB IRON.

Fig. 27

END GRAB IRON.

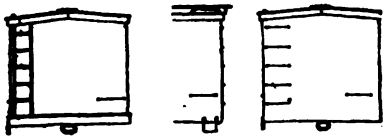
be provided with two horizontal end grabirons or handholds about 24 inches long, located on right-hand side of end of car not less than 18 inches, nor over 30 inches above center line of drawbar, as shown on Figure 29.

"All gondolas with drop ends to be provided with horizontal grabirons or handholds on sides of car over each step, about 24 inches long, located as high as possible, but not less than 18 inches nor over 30 inches above center line of drawbar, and two grabirons or handholds placed under the sill at end of car as near the face as will insure a good safe fastening, the outside end of it to be in line with the inside face of the side sill, and to be about 18 inches long with a space not less than 3 inches between it and the end sill, as shown on Figure 30. If preferred, the end handholds may be placed on the face of the end sill, as shown in the alternate illustration, Figure 30.

"All high-side, fixed-end gondolas should be equipped with a

vertical grabiron or handhold over steps on the sides of the car, about 24 inches long, the lower end to be placed about 6 inches above the floor of the car, and two horizontal grabirons or handholds on each end of car, about 24 inches long, 4 inches from the outside of car and not less than 18 inches nor over 30 inches above center line of drawbar; exception to be made where the car is provided with a brake step, in which case the bracket of the brake step can be used as a grabiron on that

Fig. 28



END LADDER AND GRAB IRON.

side of end of car, as shown on Figure 31, for low sides. It is also recommended that where the side of a gondola car is too high for a man standing on the step to reach the top, there should be two additional vertical grabirons or handholds placed on each side of end of car, extending from within 4 inches of the top, to be about 18 inches long, as shown on Figure 31.

Fig. 29

END GRAB IRONS.

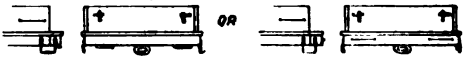
"Tank cars should be provided with horizontal grabirons or handholds, about 24 inches long, on sides over steps; but cars provided with safety railings on sides do not require side grabirons or handholds, but should be provided with two end grabirons or handholds, about 18 inches long, located on under side of end sill, the same as for drop-end gondolas and as shown on Figure 32. If preferred, the end handholds may be

placed on the face of the end sill, as shown in the alternate illustration, Figure 32.

"All flat cars to be provided with horizontal grabirons or handholds on sides of cars over steps, about 24 inches long, and if not equipped with step, one grabiron or handhold on each side near end of car, where coupler unlocking rod is located, and two end grabirons or handholds, about 18 inches long, placed under the sill as near the face as will insure a good safe fastening, the same as for drop-end gondolas, and as shown on Figure 33. If preferred, the end handholds may be placed on the face of the end sill, as shown in the alternate illustration, Figure 33.

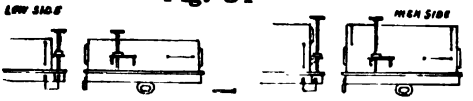
"It is also recommended that all grabirons or handholds shall be secured by through bolts of ½-inch diameter, with nuts on the outside and riveted over wherever it is possible to do so,

Fig. 30



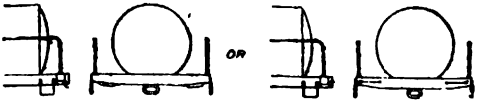
GRAB IRONS.—DROP END GONDOLA.

Fig. 31



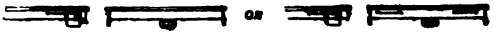
GRAB IRONS.—FIXED END GONDOLA.

Fig. 32



GRAB IRONS.—TANK CARS.

Fig. 33



GRAB IRONS.—FLAT CARS.

and where lag screws are used they shall be not less than ½-inch diameter and 3 inches long, and screwed into solid wood.

"Handholds on end sills should have at least 2 inches clearance behind them, and all other handholds should have at least 2½ inches clearance behind them.

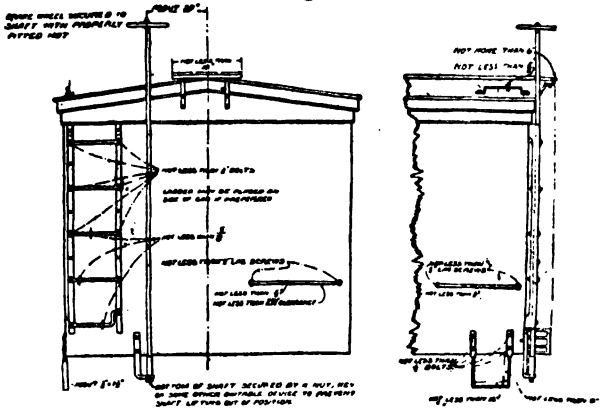
"All handholds should be made of iron not less than ⅝-inch diameter; handholds on sides and ends of cars should be about 24 inches long in the clear; those on end sills to be made shorter only when it is impossible to use this length."

Another attachment for the protection and aid of trainmen is the

Staff and Wheel Brake.—The shaft (Plate I, No. 164) if the Master Car Buliders' recommendation be followed should "be placed on what is the left hand corner of the car when a person is standing on the track facing the end of the car. The rachet wheel (Plate I, No. 121) and brake pawl (Plate I, No. 122) to be fastened to a suitable casting attached to the roof. The center of the brake shaft to be 20 inches from the middle of the car, as shown in Figure 34. The lower end of the brake-shaft is usually supported by a bracket of wrought or cast iron bolted to the end sill or by an extension of the draw-bar carry-iron (Plate I, 154). A cast iron rest or box fastened to the end sill with lag screws is provided to prevent the springing of the rod. The upper end of the shaft is guided by a casting ordinarily placed on the roof; attached to this is a pawl engaging with the ratchet wheel keyed to the shaft (Plate I, Nos. 121, 122.) The brake ratchet wheel attached to the brake shaft has teeth shaped like saw-teeth, into which the pawl or dog as it is sometimes called, engages, thus preventing the wheel and shaft from turning backward. In some forms the ratchet wheel has the ratchet upon the under side, instead of on the

edge, the pawl being automatically pressed upward against the teeth by a counterweight called the brake-pawl dog and without being adjusted by the foot of the brakeman. In other instances the arrangement of the pawl and the distance the brake staff can project above the roof of the car is the limiting figure for the length of the brake staff on all cars with super-structure similar to box cars. For flat and gondola cars the pawl

Fig. 34



POSITION OF BRAKE SHAFT STEP, LADDER AND RUNNING BOARD.

and ratchet are secured close to the floor of the car, ordinarily on the end sill, and the staff is just high enough to be operated conveniently by the trainmen. If the staff cannot project far enough above the roof to make it convenient to operate a step is provided as shown in Plate I, No. 100 for the trainmen to stand on when applying or releasing the hand brakes. This construc-

tion is not desirable but is often compulsory. The usual method of applying the brake staff is shown in Figure 34, also in Plate VIII.

Side Doors.—The simplest and most commonly used form of door (Plate I, 92) is the "batten" door. Its construction is not complicated which has probably been the reason for its general use. The boards of which it is made are similar to those used for the siding of the car. These are clinch nailed to three or more battens as indicated in the illustration, Figure 35.

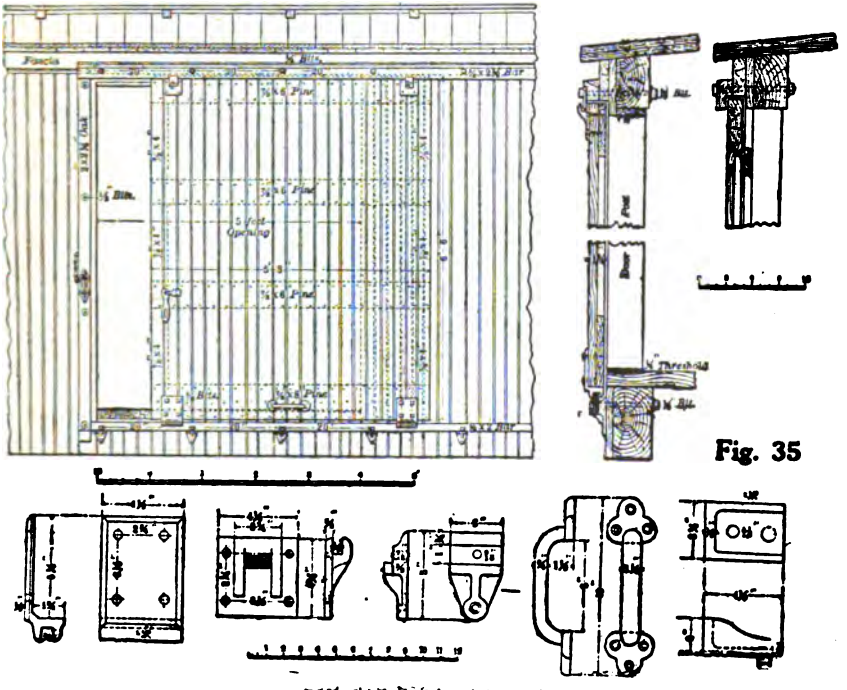
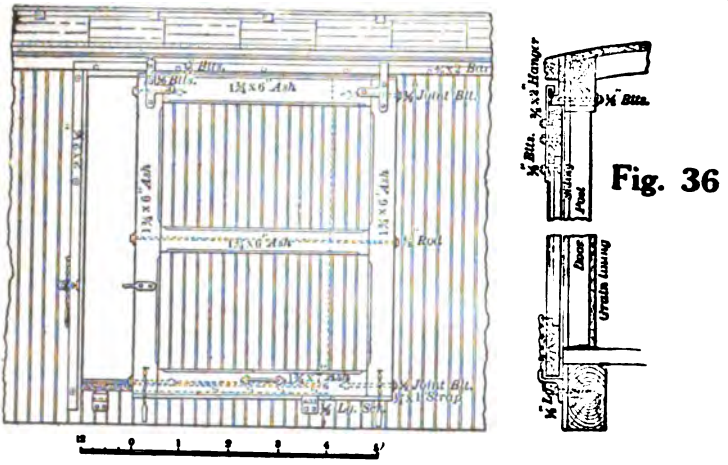


Fig. 35

BOX CAR DOOR.—BATTEN.

Another form of construction sometimes used is the framed door which consists of a hardwood frame to which a panel of sheathing is applied as indicated in the illustration, Figure 36. This construction, however, is very expensive and is not used to any great extent. The rails are subject to rotting out on account of the water which is caught on them as it runs off from the panels. A



BOX CAR DOOR.—FRAMED.

better construction of framed door and one more in general use is shown in Plate I. In this the panel of sheathing completely covers the rails (Plate I, Nos. 94, 95 and 96) and is made flush with the stiles (Plate I, 93). This door will shed the rain freely and there are no places for it to lodge and cause decay.

The material used for the frame is usually ash rather than oak, because it is less liable to dis-

tortion, a trouble which seriously interferes with the working of car doors. The stiles and rails are secured to each other by mortises and tenons or by gaining, either form of construction being used as suits the particular ideas of the designer. The form of construction of side door for box cars recommended by the Master Car Builders' Association is shown in Figure 37.

The framing and the boards composing the panel must be securely fastened together preferably with screws.

In the suspension of doors it is necessary to so arrange the details that there will be no chance for the rain to beat in around them and thus damage the lading. If the style of hanging makes a cap over the top of the door to act as a watershed there is no need of any further protection. However, if no shed is thus provided a special cap or protecting covering has to be used. This is noticeable in the details of the doors shown.

Side doors are made to slide backwards and forwards for opening and shutting, usually opening to the right. There are two general methods of construction; first supporting the door at the bottom and second, suspending it from the top.

In the first method the door slides by means of two cast iron grooved shoes secured to it by bolts with square or oval heads let in flush with the inside face of the door on a track which is a bar of wrought iron usually ½″ x 2″ section. The groove of the shoes should be ample in depth and width to prevent cramping if the track be bent. The track is as long as the door is wide with the width of the door opening added. It is blocked out from the side of the car with cast iron brackets

bolted the nuts of which should be on the inside of the sill. The door is kept in place and guided at the top by a cap which may be a hard wood strip rabbeted to fit over and hold the door. A more efficacious and stronger method is to use a strap of iron to lip over the door which is a little lighter than that used for the track and support it in place by a strip of lumber. Sometimes hooked hangers are secured to the top of the door which lip over this guiding strap with the idea of providing an auxiliary means of support for the door if the bottom rail or shoe should in any way become defective or be lost. A space is left between the door and the cap to provide against bulging of the door caused by swelling of the lumber.

The door is usually prevented from running back off its track by a stop of wood or cast iron (Plate I, No. 134) attached to the side of the car. The stop is fastened to the car by one or two lag screws or bolts extending through the siding and into the girth or into one of the posts or braces. The stop need not be used if the end of the track is turned in and bolted to the car. A closed door stop (Plate I, No. 97) is also provided to hold the door in the correct position in front of the door opening. It is of oak and is secured by bolts to the door post as shown. The suspension illustrated in Figure 35 shows the general scheme of supporting doors from the bottom and guiding them at the top.

The second method of placing doors viz., by supporting from the top, may be described as follows: A track (Plate I, No. 177), is supported immediately above the door,

cast iron thimbles at each bolt, or a strip of wood extending the length of the track, being used. The hangers (Plate I, No. 125), are of malleable or wrought iron, each fastened to the door with bolts. They are at times made plain but more frequently are provided with some form of cast or friction roliers, or sheaves, on which the door rolls. The door is guided and kept in place by cast iron brackets (Plate I, No. 127). These may be arranged to allow the proper clearance or an additional space may be allowed so that a wedge may be inserted in a slot provided for that purpose when the door is closed, thereby shutting it tighter. Sometimes a gravity button of cast iron or wood faced with a wrought iron plate is hinged with a bolt or lag screw to each lower corner of the door. This button will swing or can be forced into place when the door is shut, accomplishing the same purpose as the wedge. A good example of this type of door suspension is shown in Figure 37 which gives the Master Car Builder's Recommended doors.

Side Door Fastenings are a hasp (Plate I, No. 128) staple (Plate I, No. 130) and pin (Plate I, No. 129). These are made in various forms either of cast, malleable or wrought iron. Care should be taken that they are so securely attached with bolts that they cannot be removed when the door is closed. The pin is perforated near its point so that a wire or tin strip can be passed through it for the purpose of sealing.

The fact that a perfectly satisfactory car door is so difficult to attain has led manufacturers to make a specialty of this particular part of a car.

It would be impossible within the limits of a work of this character to give examples of all of them, but as indicating the problem to be solved and some of the methods adopted to overcome the difficulties encountered the following illustration (Figure 38) of the "Jones Car Door" manufactured by the Jones Car Door Company of Chicago is given.

For the Jones Car Door the following advantages are claimed: It has been successful in practical use; it is easily operated but is wedged fast by its own weight at whatever point left and will not slam to and fro; when closed the permanent iron cleat does away with temporary cleating and makes it a cinder, rain and dust proof door; its weight is on the wheels only when operated; it has all the good features, but not the disadvantages of a flush door; it is equipped with burglar proof brackets, one at each corner of the opening for ventilated fruit cars and one at the corner opposite the seal for ordinary box cars; when closed the door wedges against the side of the car, both top and bottom and is held snugly between the stop and permanent iron cleat.

In the operation of this door a downward pull of a few pounds on the handle (limited to two inches by a stop in the connecting rod coming in contact with the upper guide strap) raises the door on the wheels; the cleat wedge under the upper right corner of the door forces it out past the cleat and permits it to hang freely.

Illustrations Figs. 39 to 48 will serve to show the distinguishing features of some of the various forms of doors commonly met with.

End Doors.—Many box cars are not provided

with this kind of door, but it is essential in the handling of certain kinds of freight such as lumber, etc. There is no fixed rule for their loca-

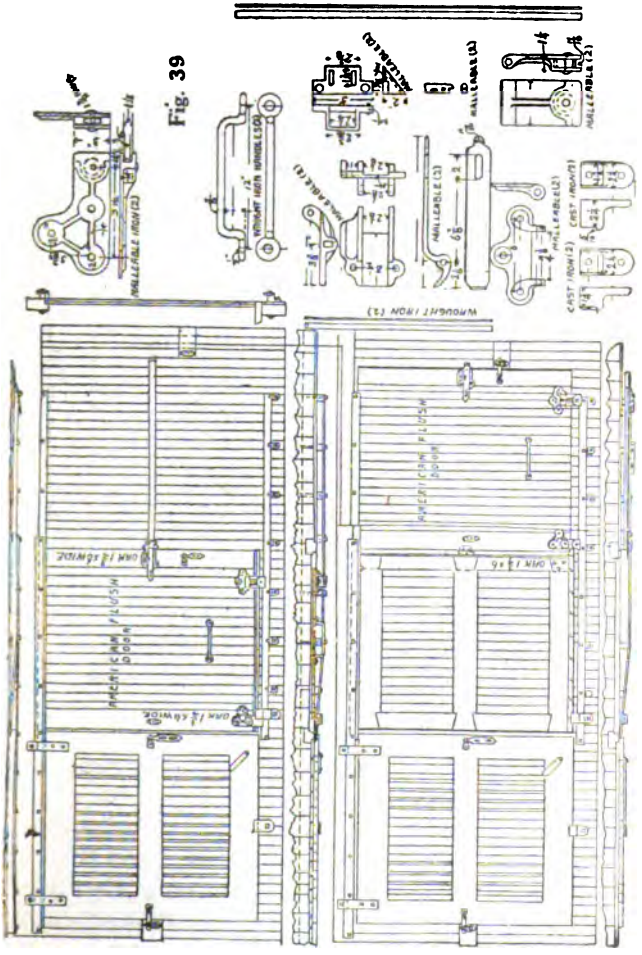


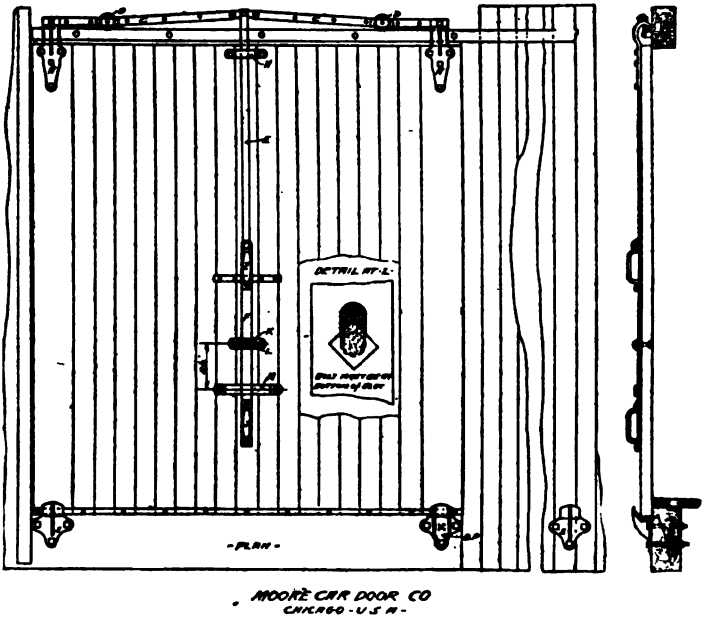
Fig. 39

AMERICAN PLUSH CAR DOOR.

tion, however, they may be said to be generally placed in the center, between the posts and above the girth. A common construction and suspension is shown in the following illustration, Figure 49:

Generally speaking the construction is the same

Fig. 40 —MOORE CAR DOOR—

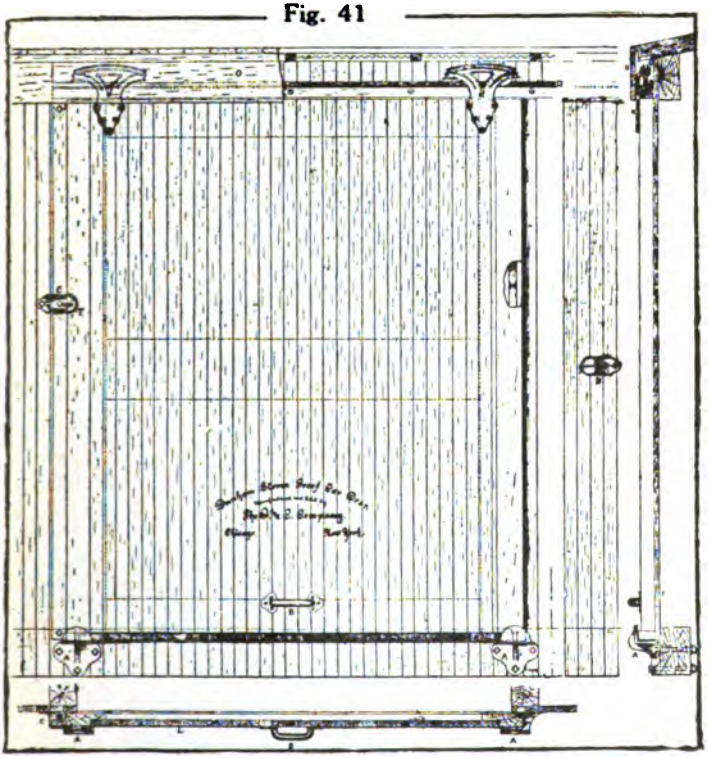


as that of the side door but on a smaller scale and what has been said about side doors refers with equal force to end doors. If the door is locked from the inside a pin and bracket are used; if on the outside, a hasp and staple with proper provision for sealing. A diagram showing the recommended

practice of the Master Car Builders' Association in regard to Box Car End door and fixtures is given in Figure 37.

Grain Doors.—The grain door (Plate I, No. 101)

Fig. 41



DUNHAM STORM PROOF CAR DOOR.

is really a continuation of the lining of the car across the door opening. It should therefore be of the same height. There are many styles in use

covered by patents. The difficulty seems to be to devise a door that is durable and undetachable. Instead of attempting to use a collapsible grain door many railroads use only a cheap slab door

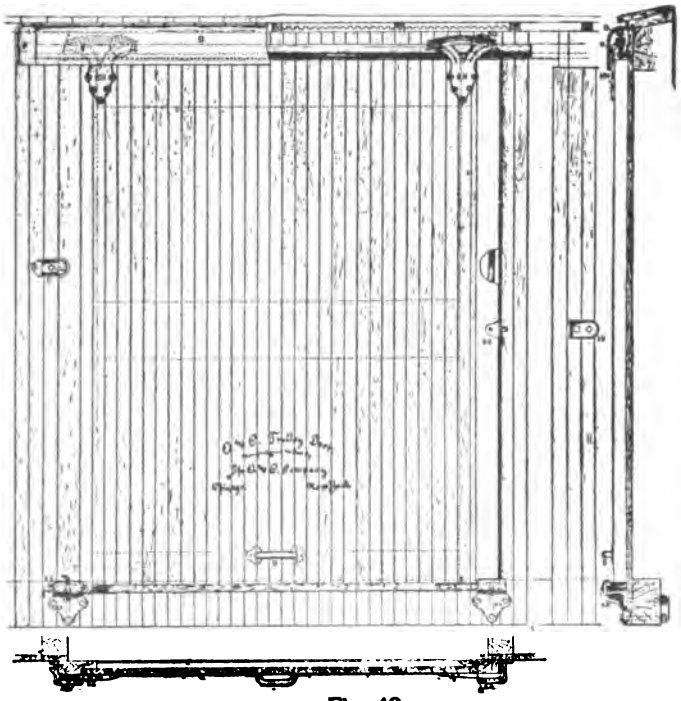


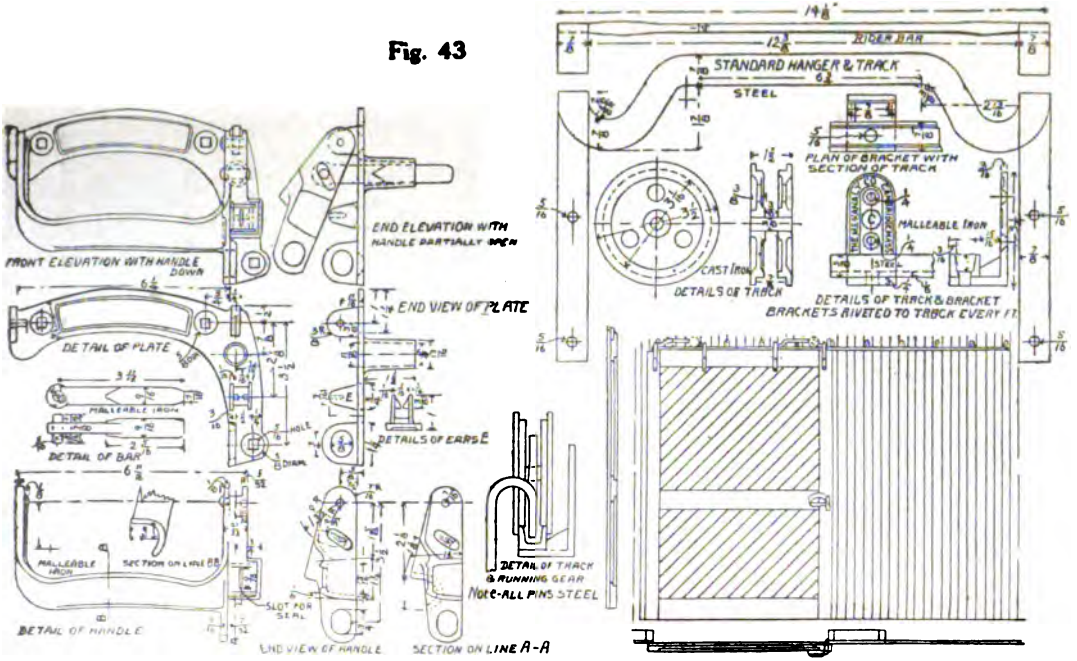
Fig. 42

Q. & C. TROLLEY DOOR.

which usually is broken up and destroyed when the car is unloaded. They find that this practice is more economical than to attempt to apply and keep in repair any form of permanent door.

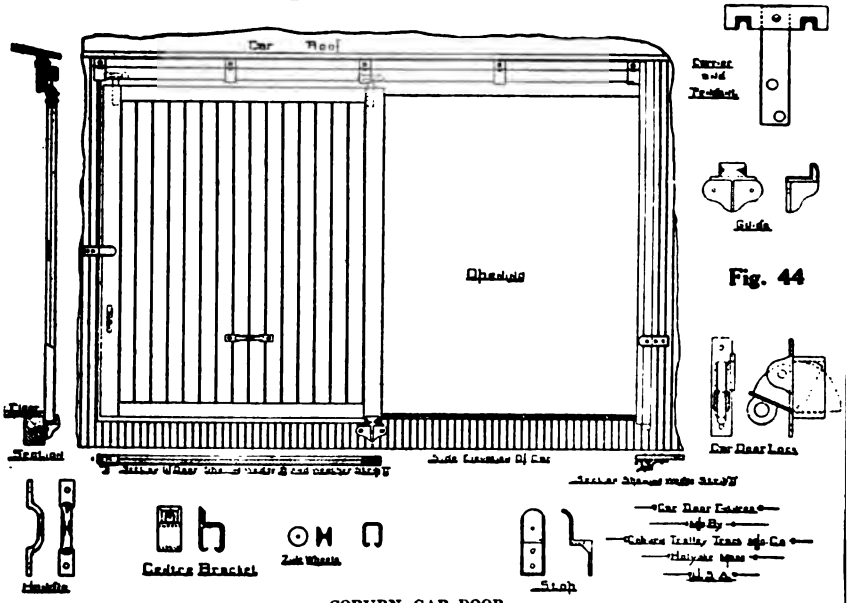
An ordinary form of grain door is given in the

Fig. 43



KANALY DOOR.

Fig. 50. This door is made with matched boards and battens of pine; the top and bottom boards are usually of oak as they are more exposed to injury. Iron guides, attached to the inside faces of the door-posts with screws, serve to hold the door when in position. The bottom of the door rests against a threshold of ¼ x 4¼ inches



COBURN CAB DOOR.

of wrought iron. Cast iron buttons secured to the side of the door posts prevent the raising of the door. A cast-iron bracket or pocket, termed a lift-iron attached to the outside near the bottom edge serves as a purchase to a bar by which the door is opened if desired before the car is unloaded. When not in use the door is suspended from the

8=ECCENTRIC ROD LEVER PAT. NO. 16 (2)
9=ECCENTRIC ROD (STEEL PIPE) (2)
10=BOTTOM ECCENTRIC ROD BRACKET PAT. NO. 9 (2)
11=MIDDLE ECCENTRIC ROD BRACKET PAT. NO. 8 (2)
12=TOP ECCENTRIC ROD BRACKET PAT. NO. 10 (2)
14=6" STRAP HINGES SCREW HOLES COUNTER SUNK ON REAR SIDE (6)

Fig. 45

18=DOOR PIN BOLT. (SPECIAL CARRIAGE BOLT) (4)
19=DOOR GUIDE. PAT. NO. 19 BURGLAR PROOF. LOCATED AT B (2)
20=DOOR GUIDE. PAT. NO. 12 LOCATED AT C (2)
21=DOOR GUIDE. PAT. NO. 14 BURGLAR PROOF. LOCATED AT A (2)

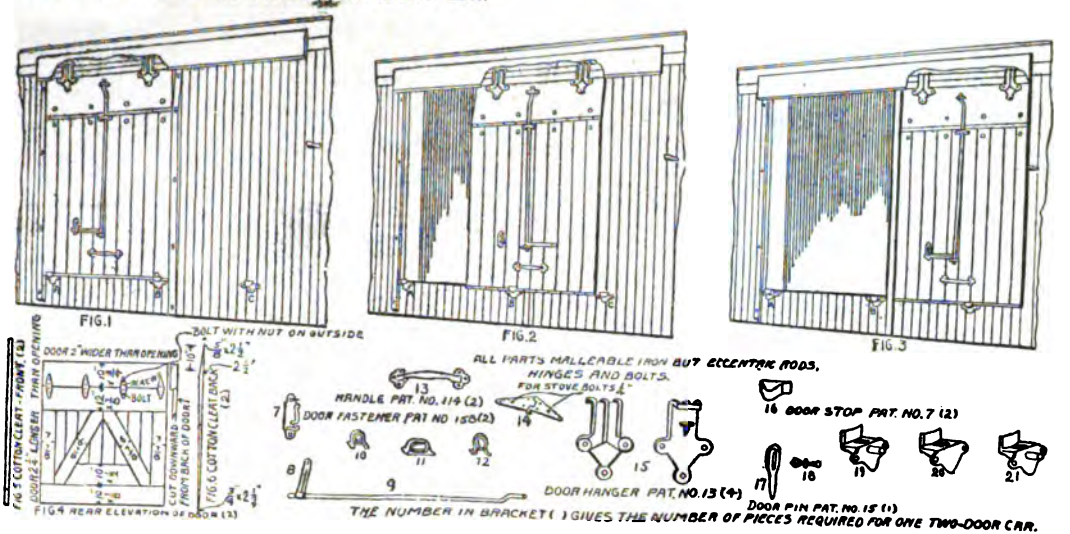


FIG. 1
FIG. 2
FIG. 3
BOLT WITH NUT ON OUTSIDE
DOOR 2" WIDER THAN OPENING
BRACE
BOLT
CUT TOWARD FRONT BACK OF DOOR
FIG. 5 COTTON CLEAT - FRONT (2)
FIG. 6 COTTON CLEAT BACK (2)
FIG. 4 REAR ELEVATION OF DOOR (1)
ALL PARTS MALLEABLE IRON BUT ECCENTRIC RODS, HINGES AND BOLTS.
HANDLE PAT. NO. 114 (2)
FOR STOVE BOLTS 1/4"
DOOR FASTENER PAT NO 150 (2)
DOOR HANGER PAT. NO. 13 (4)
16 DOOR STOP PAT. NO. 7 (2)
DOOR PIN PAT. NO. 15 (1)
THE NUMBER IN BRACKET ( ) GIVES THE NUMBER OF PIECES REQUIRED FOR ONE TWO-DOOR CAR.

EUBANK CAR DOOR.

plate, close to the doorway on hooks or pins. A short chain is used to prevent the door being carried off.

As in the case of side doors there are many special and patented forms of grain doors in use of more or less complexity. One example is the

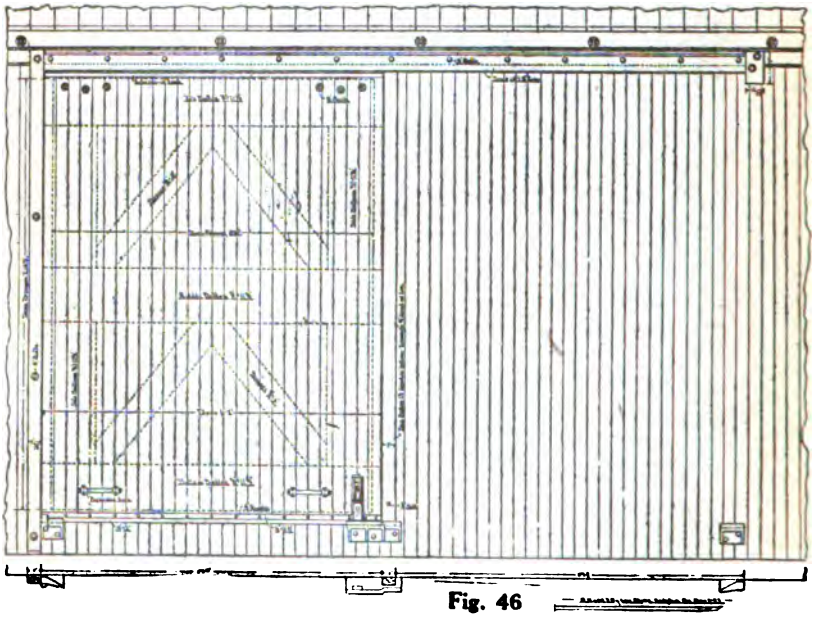


Fig. 46

A. B. PULLMAN CAR DOOR.

Canales Grain Door the construction of which is indicated in the following drawing, Figure 51.

The Canales grain door consists of a frame B which rests against the inside of the permanent door frame of the car and in the lower portion of the frame B are hinged two steel shutters D and

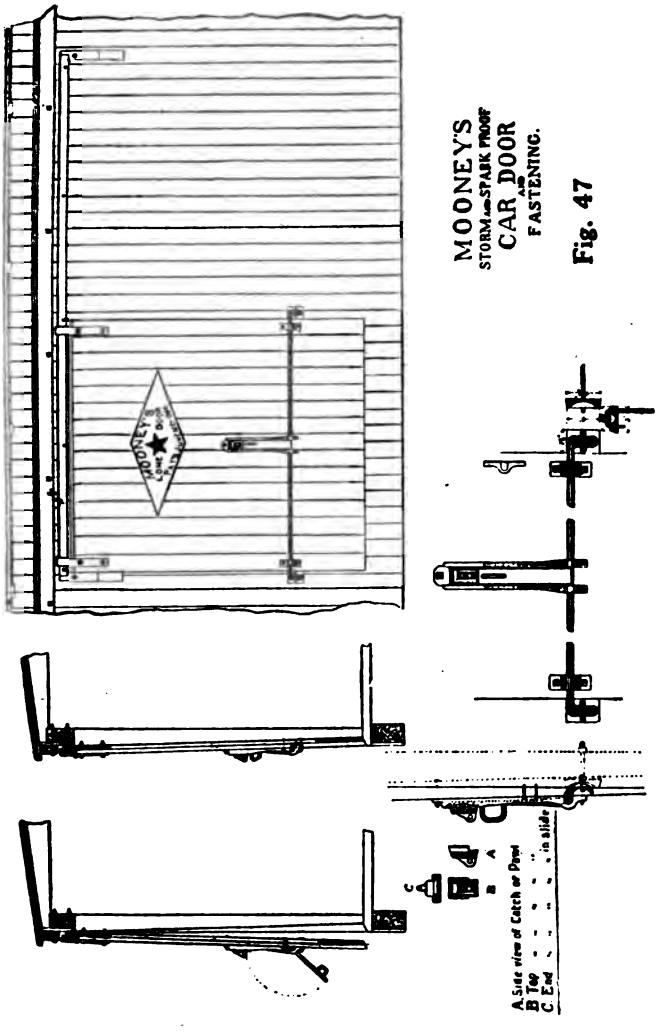
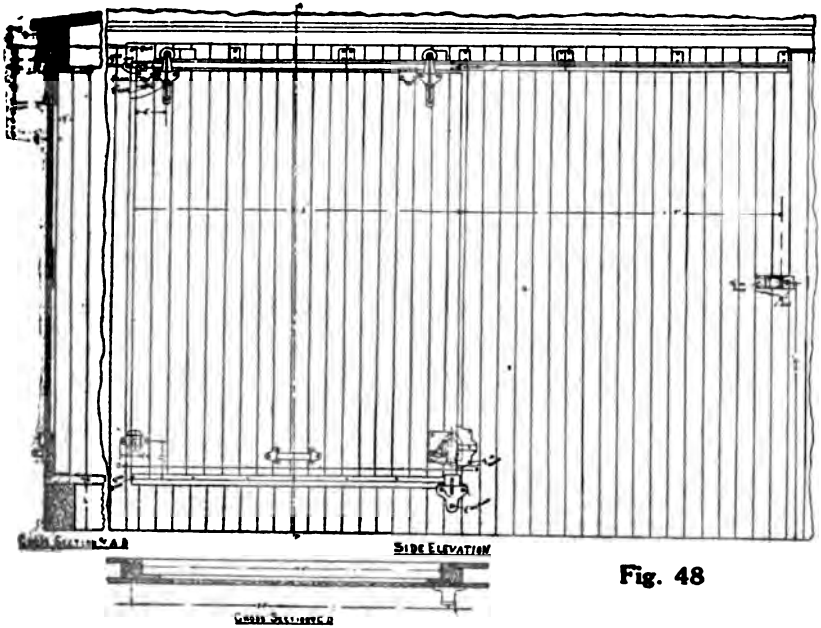
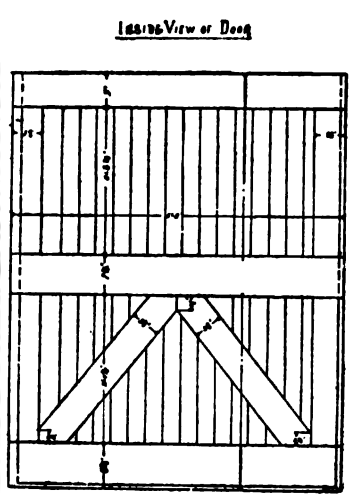

MOONEY'S
STORM and SPARK PROOF
CAR DOOR
AND
FASTENING.
A. Side view of Catch or Pawl
B Top
C End

Fig. 47



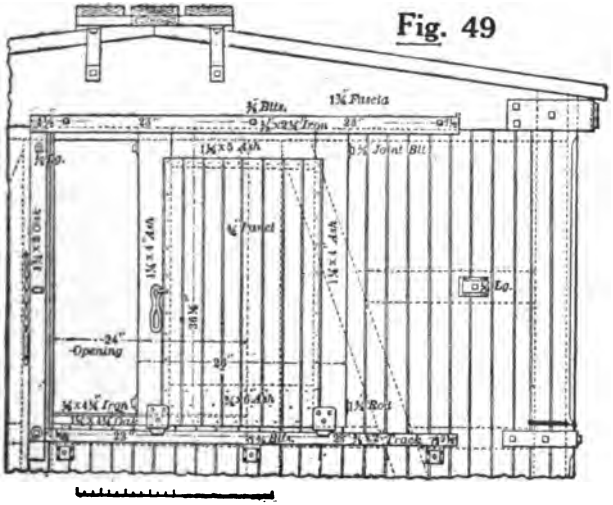


THE SMART
Automatic Flush
SIDE DOOR for BOX CARS
The Sawyer Car Door Co.
Keene, N.H.

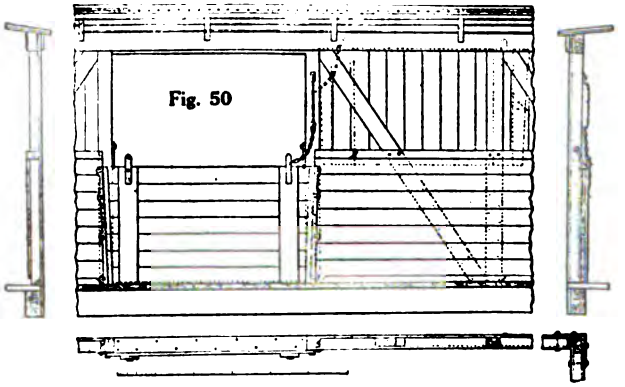
Fig. 48

D1 so arranged that they swing from the inside outward. The shutters are riveted to a cross bar d which is journalled in the side of the frame B. The space from the shutter D to the top of the frame is filled in by the panel c. The shutters are held in position by vertical levers E which are hinged at the top of the frame B. The lower end of each bar is locked in place by an arm g, secured

Fig. 49


Panel
Opening
Joint Bill
Eq.
Eq.
Bill
Bill
Bill

pin is pulled the lower ends of the levers E are released and the shutters are free to swing outward, thus discharging the grain from the two openings. The door is prevented from lifting by guides j on the inside of the car and it is prevented from moving laterally by the angle pieces j' which slip down over the corners of the door frame and are dove-tailed to the guide.



GRAIN DOOR.

"The McGuire Star Grain Door" is illustrated in Figure 52, which shows the single and double door, both in position and stored under the roof. The single door can be applied up to a height of 3′ 6″; if a higher door than this is wanted, the double door with the additional leaf or flap is necessary.

The "Chicago Rabbeted Grain Door" differs only slightly from the McGuire in minor details. It is illustrated in Figure 53.

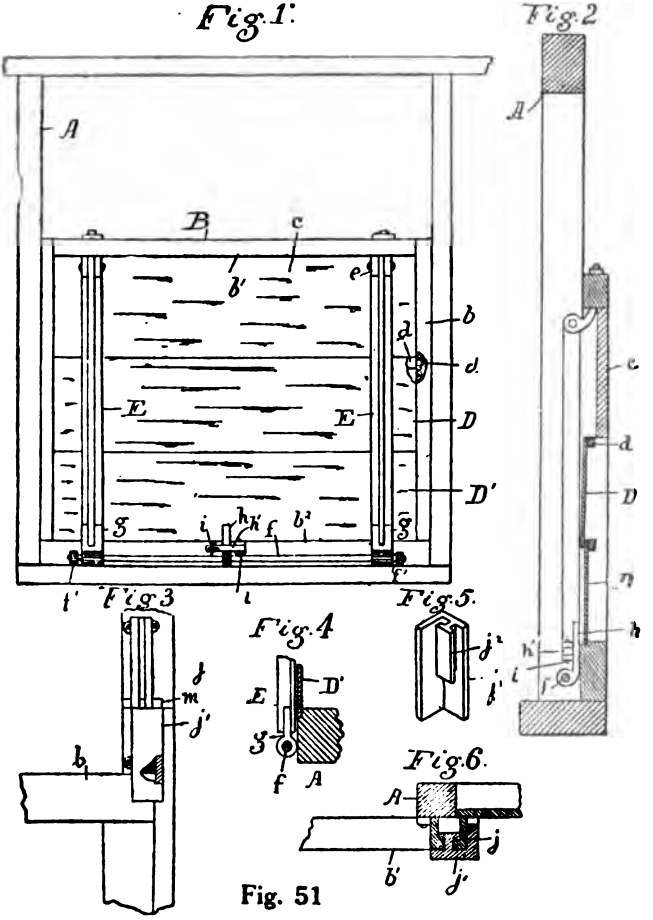
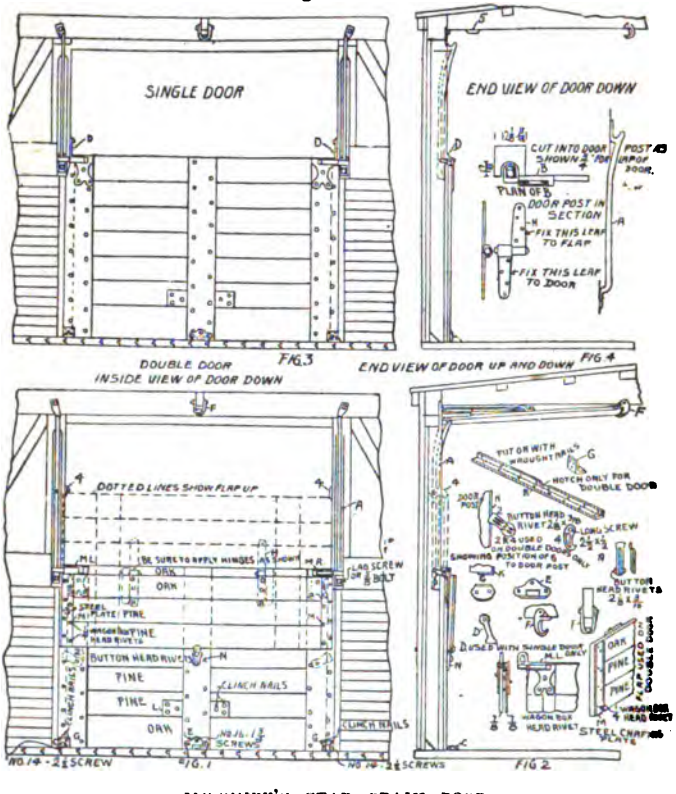


Fig. 51

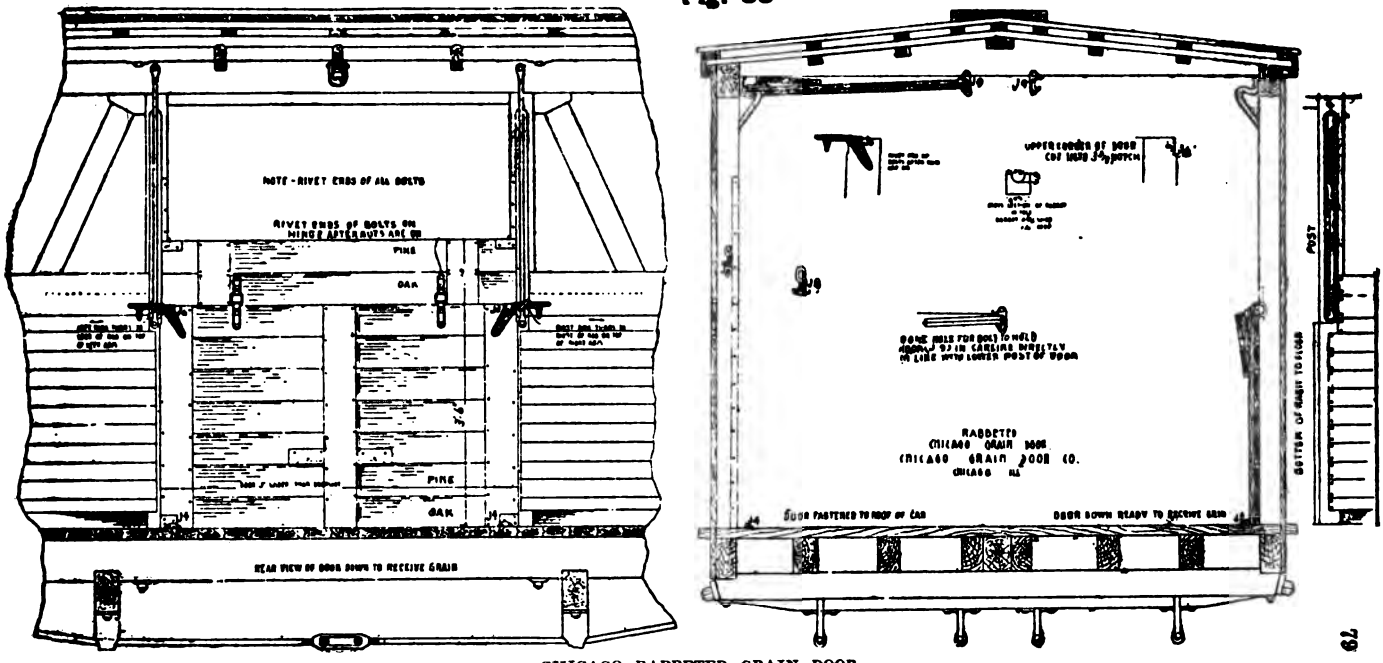
CANALE'S PATENT GRAIN DOOR.

Fig. 52



MC GUIRE'S STAR GRAIN DOOR.

Fig. 53



CHICAGO RABBETED GRAIN DOOR.

CHAPTER IV.

THE FREIGHT CAR TRUCK.—THE DETAILS, WHEELS, AXLES, JOURNAL BOXES, ARCH BARS, TIE BARS, BOLSTER, SPRING PLANKS, SPRINGS.

The essential members of a truck it will be noted are: Wheel, (Plate II, No. 1); Axle, (Plate II, No. 7); Journal Boxes, (Plate II, No. 35); Arch Bars, (Plate II, Nos. 31, 32); Tie Bars, (Plate II, No. 33); Truck Columns, (Plate II, No. 14); Bolster, (Plate II, No. 38); Springs, (Plate II, No. 43).

Wheels.—These are circular frames or disks revolving on an axis, which support the truck upon the rails and upon which the vehicle moves. They were at first very much like the ordinary wheels of a common wagon and were guided by a flange or lip on the outside of the rail. The flange on the wheel was a later device. Car wheels are either cast solid and chilled or are steel-tired. Those used under freight cars are almost invariably made of cast iron, tough in the center and chilled hard in the tread and flange. Figure 61, shows the details of cast-iron wheels recommended by the Master Car Builders' Association. The following are the specifications adopted by one of the largest and best managed railroads of the country, for its cast iron wheels. In this connection, it should be said that all wheels for passengers cars are guaranteed by the makers to perform a certain mileage and all wheels for freight cars to last an agreed length of

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time. As it would be impossible to ascertain the mileage of wheels under freight cars which are constantly running on other company's lines, the time basis becomes necessary.

SPECIFICATIONS FOR CAST IRON WHEELS.

All cast iron wheels purchased by or used in the construction of cars for this company must meet the requirements of the following specifications:

Kind of Wheel	Diam	Weight	Min Weight	Drop test No of blows	Guarantee Mileage	Guarantee Time
Passenger cars	36″	750	735	12	85,000	
Passenger cars	33″	650	638	10	75,000	
Large freight cars.	33″	600	590	8		6 years
Small freight cars.	33″	550	540	7		6 years

The design of the wheels must conform in the tread and flange to the standard form adopted by the Master Car Builders' Association, and in position of hub and length of same to the drawings accompanying these specifications.

Each wheel must have cast upon it the name of the maker, date of casting, weight and number. Wheels for passenger cars must have the letters "Pass.," and wheels for freight cars must have the letters "Frt." cast upon them in letters not less than 1¼ inches long.

The circumference of each wheel must be measured by the maker and a mating number put on it with light colored paint, as follows:

If wheel is ¼″ large mark it "I."
If wheel is ⅛″ large mark it "II."
If wheel is nominal mark it "0."
If wheel is ⅛″ small mark it "III."
If wheel is ¼″ small mark it "IIII."

The nominal circumference of wheels made at any one foundry must always be the same.

Each wheel must have cast upon its back a record brand as shown on drawing accompanying specifications.

Wheels must be so nearly circular that when a ring gauge, made truly circular, is placed over the tread and touches at any point, it will not be more than $^1/_{32}$ inch away from the tread at any other point.

Flange gauges made as shown on drawing accompanying these specifications will be used to determine the maximum and minimum thickness of the flanges that will be accepted.

The flange on the same wheel must not vary more than 3/32 inch in thickness.

The Master Car Builders' standard tape will be used for measuring the circumference of wheels. Wheels will not be accepted for any service if the circumference varies more than ¼ inch from the nominal circumference. Wheels will not be accepted for passenger car service if the circumference varies more than ⅛ inch from the nominal circumference.

The body of the wheel must be free from blow holes, slag, etc., and the hubs solid and free from drawing. The tread and throat must be smooth and free from chill marks, wrinkles, slag and sweat.

The fractures of the wheels broken must show clean grey iron free from slag, dirt, honey-combing, etc.

The depth of the clear white iron must not be more than ⅞ inch, nor less than ½ inch in the middle of the tread, nor more than ¾ inch, nor less than ⅜ inch at the throat and must not vary more than ¼ inch in depth around the tread or flange in the same wheel.

For each 51 wheels or fraction thereof, offered for inspection or from each day's make, if less than 51 wheels are made on one day, one wheel will be selected by a representative of the Railway Company and subjected to the following test for strength:

The wheel will be placed flange downward upon an anvil block weighing not less than 1,700 pounds, set on rubble masonry 2 feet deep, and having 3 supports not more than 5 inches wide, for the flange to rest upon. It shall be struck centrally upon the hub by a weight of 140 pounds falling from a height of 12 feet. The minimum number of blows which each size wheel must stand without breaking into two or more pieces is shown by the table at the head of these specifications.

If the wheel tested breaks into two or more pieces under the test, the 50 wheels or fraction thereof represented by it will be rejected. If, however, the wheel should stand the test the 50 wheels or fraction thereof represented by it will be accepted, subject to the return of all wheels that are found upon boring and mounting to be defective, or that do not conform to these specifications.

Claim for replacement shall be made on the following basis: Bills will be rendered against the manufacturers of the wheels, or car builders (if placed under by such) for the difference between the cost of the new wheel delivered to the Railway Company, less the mileage or time made by the wheel, and the value of the scrap computed on the basis of the agreed valuation per gross ton for same. To which will be added 50 cents for each freight wheel and 75 cents for each passenger wheel for the labor of removing and

replacement of all failing to make their guaranteed time or mileage. The following example illustrates the method of computing:

Value of new wheel, say....$8.00
Value of scrap, say..... 4.00

Net cost .....$4.00 for 75,000 miles, or 5.7 cents per 1,000 miles.
35,000 miles shortage at 5.7 cents per 1,000 miles.....$1.99
Add for labor of changing..... .75

$2.74

Passenger car wheels will be figured on the basis of 1,000 miles. Freight car wheels will be figured on the basis of months. No fraction of month or 1,000 miles will be considered.

No credit will be allowed manufacturers for wheels that make more than the guaranteed mileage or time.

In failure of wheels to make the guaranteed mileage or service in time, each wheel will be considered independently of its mate on the same axle and without reference to its location in truck. No claim for failure of a wheel shall be made on account of failure of its mate, nor shall claim for failure on account of defect of any wheel bar a claim for failure on account of similar defect of its mate, or other wheels located in same truck.

Claim for failure to make guaranteed mileage or time service will be made and prompt settlement required when caused by any of the following defects:

1. Shelled out, if due to quality of the metal.
2. Comby.
3. Seams.
4. Worn through chill or worn hollow.
5. Burst, if under 30 tons pressure.
6. Broken flange, when not caused by being worn thin or derailment.
7. Cracked plate.
8. Cracked brackets.
9. Broken in pieces if not due to wreck or derailment.

No failed wheels will be held longer than one week for manufacturers' inspection, the Railway Company reserving the right to dispose of the same promptly and to its best advantage. Manufacturers, however, will be given facilities and assistance in the inspection of any wheels that are awaiting disposition which have been removed for defects chargeable to manufacturers under these specifications.

THERMAL TEST.

From each day's make of wheels, one will be selected by the representative of the Railway Company and subjected to the following thermal test:

The wheel must be laid flange down in the sand, and a channel way one and one-half (1½) inches wide, and four (4) inches deep, must be molded with green sand around the wheel. The clean tread of the wheel must form one side of this channel way, and the clean flange must form as much of the bottom as its width will cover. The channel way must then be filled to the top with molten cast iron, which must be hot enough when poured, so that the ring which is formed when the metal is cold shall be solid or free from wrinkles or layers. The time when the pouring ceases must be noted, and two minutes later an examination of the wheel must be made. If the wheel is found broken in pieces, or if any crack in the plate extends through the tread, the wheels represented by the tests will be rejected.

Wheels will be inspected and tested at the works where they are made. The manufacturers must notify the proper official of the Railway Company at least two days before the wheels will be ready for inspection and must furnish, free of cost, test wheels, testing apparatus and assistance necessary to make satisfactory inspection and tests. If the Engineer of Tests prefers to test and inspect the wheels after they reach their destination, the manufacturer will be notified to ship them with the understanding that if they fail to meet the requirements of these specifications, they will be rejected and returned at the expense of the manufacturers.

The following standard terms and gauging points for wheels and track have been adopted by the Master Car Builders' Association:

1.—Track rails are the two main rails forming the track.

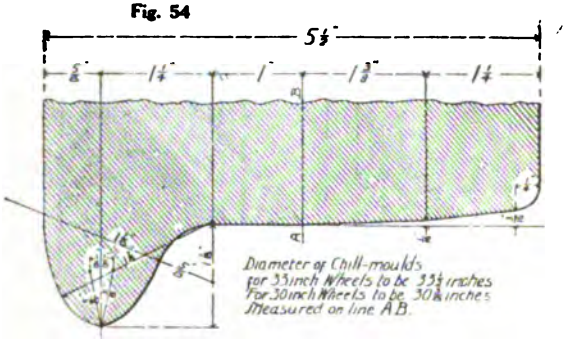
2.—Gauge of Track is the shortest distance between the heads of track rails.

3.—Base Line, for wheel gauges, is a line parallel to the axis of the wheels drawn through the point of intersection of tread with a line perpendicular to the axis, and passing through the center of the throat curve.

4.—Inside Gauge of Flanges is the distance between backs of flanges of a pair of mounted wheels measured on a line parallel to the base line, but ¼ inch nearer to the axis of the wheels.

5.—Gauge of Wheels is the distance between the outside faces of flanges of a pair of mounted wheels measured on a line parallel to the base line, but $^{17}/_{64}$ inch farther from the axis of the wheels.

Fig. 54



MASTER CAR BUILDERS' STANDARD WHEEL TREAD AND FLANGE.

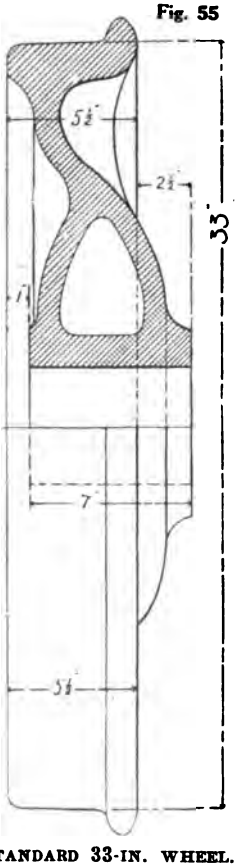
6.—Thickness of Flange is the distance measured parallel to the base line between two lines perpendicular thereto, one drawn through the point of measurement of "inside gauge of flanges," and the other drawn through the point of measurement of "gauge of wheels."

7.—Width of Tread is the distance measured parallel to the base line from a line perpendicular thereto, drawn through the point of measurement of "gauge of wheels" to the outer edge of tread.

8.—Check Gauge Distance is the distance measured parallel to the base line between two lines perpendicular thereto, one drawn through the

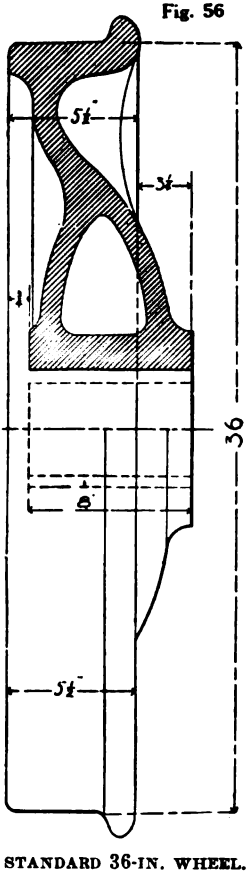
point of measurement of "inside gauge of flanges" on either wheel, and the other drawn through point

Fig. 55



STANDARD 33-IN. WHEEL.

Fig. 56



STANDARD 36-IN. WHEEL.

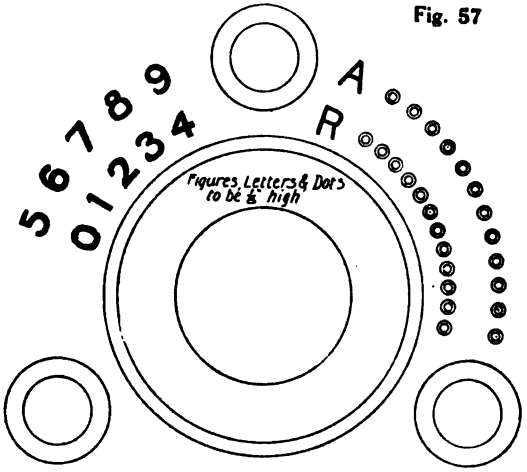
of measurement of "gauge of wheels" on mate wheel.

9.—Over all Gauge is the distance parallel to base line from outer edge of one wheel to the outer edge of mate wheel.

The above mentioned wheel gauge distances are either directly or by inference as follows:

Inside gauge of flanges	4 feet	5⅜ inches.
Gauge of wheels	4 "	8⅛ "
Thickness of flange		1⅜ "
Width of tread		4⅛ "
Check gauge distance	4 "	6¾ "
Over all gauge	5 "	4⅜ "

Fig. 57



The figures indicating the years must be changed annually so that 10 years' record will be shown on each wheel.

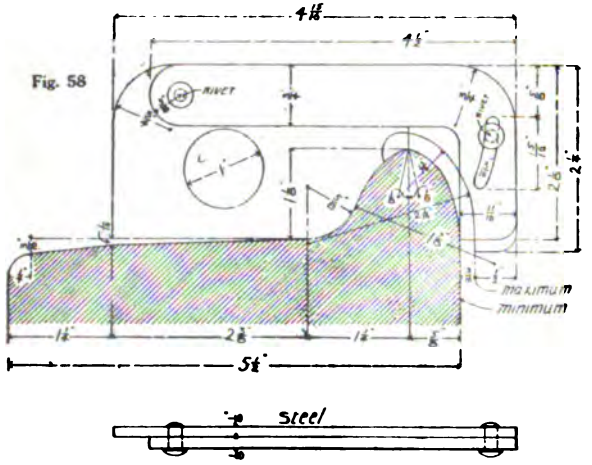
CAST WHEEL RECORD BRAND.

These terms and gauging points are illustrated in the accompanying chart, Figure 59, which also shows the standard reference, check and guard rail gauges.

The following drawing, Figure 60, illustrates

the Master Car Builders' standard gauge for locating the wheels equidistant from the center of the axle. The association has decided that all axles should be carefully marked at the exact central point between the centers of the journals and that in mounting wheels, they should be carefully gauged from this center mark.

Fig. 58



STANDARD GAUGE FOR FLANGE OF CAST IRON WHEELS.

In selecting and mounting wheels, the recommended practice of the Association is as follows:

MOUNTING WHEELS.

First. That wheels with flanges worn to a thickness of 1 $^{1}/_{16}$ inches or less shall not be remounted.

Second. That the thickness of flanges of wheels fitted on the same axle should be equal and should never vary more than $^{1}/_{16}$ inch.

Third. That in mounting wheels, new or second hand, the standard wheel check gauge should be used in the following manner:

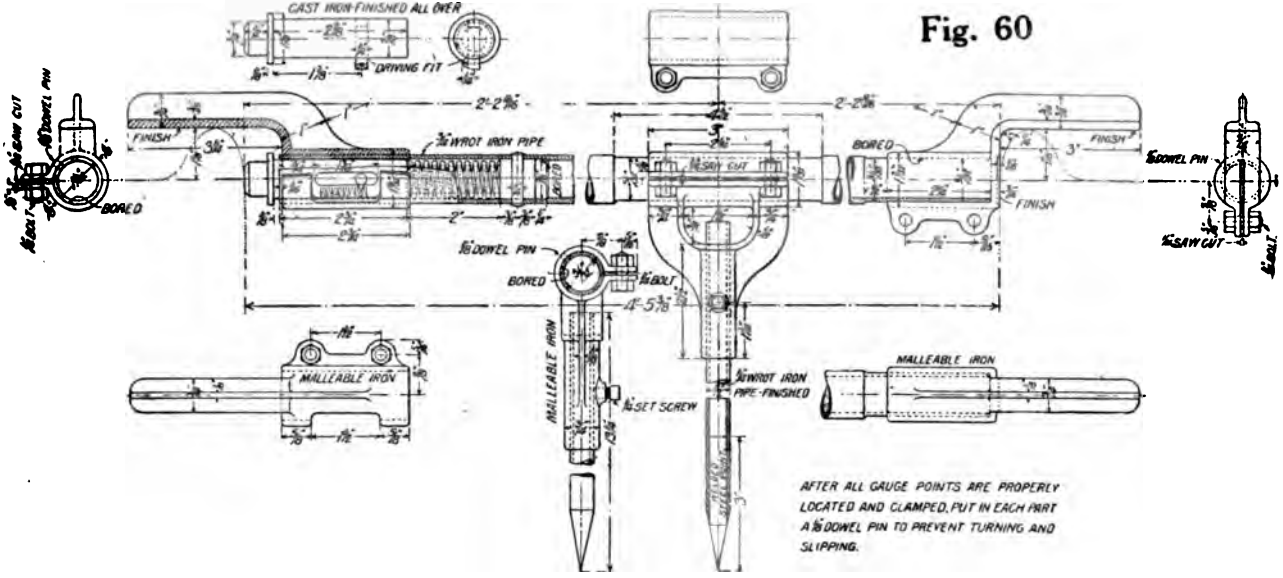


Fig. 60

STANDARD GAUGE FOR LOCATING WHEELS EQUIDISTANT FROM CENTER OF AXLE.

After one wheel is pressed into position, place the stop "A" or "B" of the check gauge (Figure 59) against the inside of the flange of the wheel with the thinner flange with the corresponding tread stop "C" or "D" against the tread of the wheel. Press the other wheel on the axle until the opposite tread stop comes in contact with the tread with the corresponding gauge point "E" or "F" in contact with the outside of the thicker flange.

The specifications for 33-inch cast-iron car wheels recommended by the Master Car Builders' Association, are as follows:

SPECIFICATIONS FOR 33-INCH CAST-IRON WHEELS WEIGHING 600, 650 AND 700 POUNDS FOR CARS OF 60,000, 80,000 AND 100,000 POUNDS CAPACITY.

1. Chills must have the same inside profile as shown by M. C. B. drawing of wheel tread. The inside diameter of chill must be the M. C. B. standard of 33½ inches, measured at a point 2⅝ inches from outside of tread of wheel.

2. Wheels of the same nominal diameter must not vary more than one-fourth (¼) of an inch above or below the mean size measured on the circumference, and the same wheel must not vary more than one-sixteenth $^1/_{16}$ of an inch in diameter. The body of the wheel must be smooth and free from slag, shrinkage or blow holes. The tread must be free from deep and irregular wrinkles, slag, chill cracks and sweat or beads in throat, and swollen rims.

3. The wheels broken must show clean gray iron in the plates, except at chaplets where mottling to not more than one-half (½) inch from same will be permitted. The depth of pure white iron must not exceed one (1) inch, nor be less than one-half (½) inch in the middle of the tread, and shall not be less than three eighths (⅜) inch in the throat for wheels weighing six hundred (600) pounds. It shall not exceed one (1) inch in the middle of the tread nor be less than seven-sixteenths 7/16) inch in the throat for wheels weighing six hundred and fifty (650) pounds, and shall not exceed one (1) inch in the tread or be less than one-half (½) inch in the throat for wheels weighing seven hundred (700) pounds. The depth of the white iron shall not vary more than one-fourth (¼) of an inch around the tread on the rail line in the same wheel.

4. For each hundred wheels which pass inspection and are ready for shipment, two representative wheels shall be taken at random, one of which shall be subjected to either of the following tests:

The wheel shall be placed flange downward on an anvil block, weighing not less than seventeen hundred (1,700) pounds, set on rubble masonry at least two (2) feet deep, and having three supports not more than five (5) inches wide to rest upon. It shall be struck centrally on the hub by a weight of two hundred (200) pounds. For six hundred (600) pound wheels, ten (10) blows falling from a height of nine (9) feet. For six hundred and fifty (650) pound wheels, twelve (12) blows falling from a height of ten (10) feet, and for seven hundred (700) pound wheels, twelve (12) blows falling from a height of twelve (12) feet. Should the test wheel stand the given number of blows without breaking in two or more pieces, the inspector will then subject the other wheel to the following test:

The wheel must be laid flange down in the sand, and a channel way one and one-half (1½) inches wide, and four (4) inches deep, must be molded with green sand around the wheel. The clean tread of the wheel must form one side of the channel way, and the clean flange must form as much of the bottom as its width will cover. The channel way must then be filled to the top with molten cast iron, which must be hot enough when poured, so that the ring which is formed when metal is cold shall be solid or free from wrinkles or layers. The time when the pouring ceases must be noted, and two minutes later an examination of the wheel must be made. If the wheel is found broken in pieces, or if any crack in the plate extends through the tread, the one hundred wheels represented by the tests will be rejected.

5. In case of the drop tests, should the test wheel break in two or more pieces with less than the required number of blows, then a second wheel shall be taken from the same lot and similarly tested. If the second wheel stands the test, it shall be optional with the inspector whether he shall test a third wheel or not; if he does not do so, or if he does and the third wheel stands the test, the hundred wheels shall be accepted as filling the requirements of the drop test.

6. The lower face of the weight of two hundred (200) pounds shall be eight (8) inches in diameter, and have a flat face.

7. Wheels shall not vary from the specified weight more than two per cent.

8. The thickness of the flange shall be regulated by the maximum and minimum flange thickness gauges adopted by the Master Car Builders' Association.

9. All wheels must be numbered consecutively in accordance with instructions from the railroad company purchasing them, and shall have the number, the normal weight of the wheel, also the day, month and year when made, plainly formed on the inside plate in casting, and no two wheels

shall have the same number. All wheels shall also have the name of the maker and place of manufacture plainly formed on the outside plate in casting.

10. Individual wheels will not be accepted which

(1). Do not conform to standard design and measurements.
(2). Are under or over weight.
(3). Have physical defects described in Section 2.

Any lot of one hundred wheels submitted to test will not be accepted:

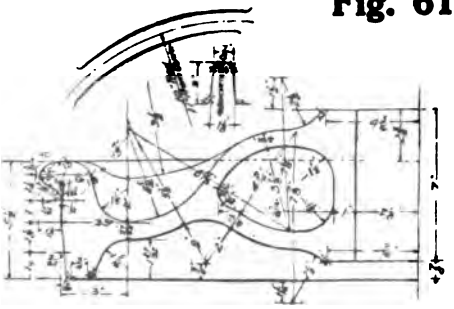
(1). If wheels do not meet the prescribed drop test.
(2). If the wheel tested does not stand the thermal test.
(3). If the conditions prescribed in Section 3 are not complied with.

11. All wheels must be taped with the M. C. B. standard design of wheel circumference tape, having numbers 1, 2, 3, 4, 5 stamped one-eighth (⅛) inch apart, the figure three (3) to represent the normal diameter, 103.67 inches circumference, the figure one (1) the smallest diameter, and the figure five (5) the largest diameter.

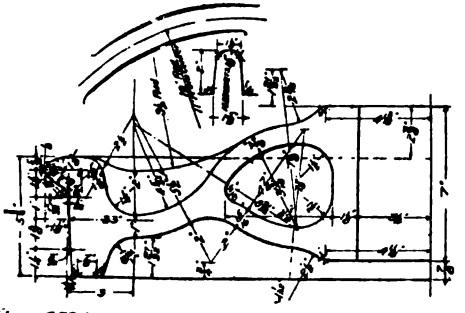
In connection with these specifications, the Master Car Builders' Association has recommended thirty-three-inch cast-iron car wheels of the design shown in Figure 61, for 60,000 pound, 80,000 pound and 100,000 pound capacity cars. The various wheel makers have designs of their own which are the result of years of experience and test, and in such details, their results are perfectly reliable.

Axles.—The car axle is the metal shaft (Plate II, No. 7) of wrought iron or steel upon which a pair of wheels is mounted. Both wheels are rigidly secured to the axle. The practice is to hold the wheel to the axle by close fitting of the parts, the wheels being forced into the axle by hydraulic pressure, a force of not less than thirty tons being used. It has been attempted to make one or both of the

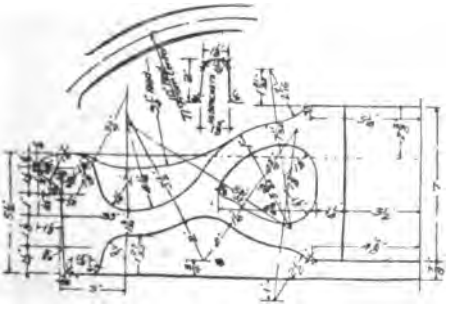
Fig. 61



33-INCH 600-LB. CAST-IRON WHEEL FOR 60,000-LB. CAPACITY CARS.



33-INCH 650-LB. CAST-IRON WHEEL FOR 80,000-LB. CAPACITY CARS.



33-INCH 700-LB. CAST-IRON WHEEL FOR 100,000-LB CAPACITY CARS.

CAST IRON WHEELS

MASTER CAR BUILDERS' RECOMMENDED 33-INCH CAST IRON WHEELS.

wheels loose so that they could turn independently of the axle, but experience demonstrated that the gain was less and the loss greater than had been supposed. The parts of the car axle beginning at the middle are known as center, neck, wheel-seat, dust guard bearing, journal and collar.

In regard to the metal available for axles, it may be said that choice is becoming limited to the stronger grades of steel. When good scrap iron of the best grade can be obtained and it can be properly worked under the hammer, it answers the purpose for axles for cars as well as steel. However, good scrap iron is hard to be obtained, and because of the fact that small pieces of an inferior grade of iron or even pieces of steel are apt to be unintentionally used in the making of a hammered iron axle, many railroads are using only steel axles as a matter of safety. Where a railroad has the facilities for making its own axles and also has enough high grade scrap iron, it usually sticks to the use of the iron axles. The dimensions of the M. C. B. axles are ample for keeping the maximum fibre stresses within safe limits with good hammered iron. In the selection of steel, for axles careful consideration has to be taken of its chemical and physical properties the same as is done with iron axles. Its method of manufacture also has a great deal to do with its successful use. The resultant axle should have a high elastic limit, should be free from internal stresses, should be tough and above all should be uniform in structure and strength. These requirements refer to iron as well as steel axles.

Speaking on the subject of the proper material

for use in car axles an eminent authority on metals* says as follows:

"It has been thought that a pre-eminently safe metal was to be found in the softer, and initially very ductile, grades of puddled iron. The drop test, on new material, may have encouraged this belief. But initial ductility in an axle, like that of a rail, noes not insure the retention of this property after prolonged and severe conditions.

"A soft iron axle is easily ruptured by repeated alternate loads of low magnitude, which would cause no appreciable deterioration in a high grade steel axle. Two hundred million repetitions of load are not unusual in the life of some axles. To attain so great a limit of endurance the maximum fibre stresses must be kept very low, particularly so if an iron axle of low elastic limit is used.

"An exceptional overload, such as might result from derailment, should be met by adequate latent toughness to endure bending without breaking, but it must be borne in mind that repeated alternate stresses are competent to rupture any grade of iron or steel with hardly an appreciable display of ductility. The stress which will promptly accomplish this result is lower for a weak metal than for a strong one.

"It is a difficult question to decide how it is best to obtain high physical properties, whether by chemical composition, heat, or mechanical treatment, but it is quite certain that high strength must be present to resist high stresses.

"Illustrating the effect of repeated stresses on different grades of steel, between 300 and 400 experimental bars have been tested at the Watertown Arsenal, all grades of steel from soft to hard, and without exception it has been possible to rupture all of those bars without—well—with hardly a measurable display of elongation.

"The mechanical work necessary to rupture different grades of steel is not strikingly unlike in amount, whether a mild steel or a hard steel is ruptured. In round numbers about one thousand foot-pounds of mechanical work will rupture a cubic inch of steel, when ruptured in tension, by a single application of force. Under repeated stresses the metal may endure hundreds of thousands or millions of foot-pounds work without rupture.

"Under a force once applied a piece of steel one inch long may elongate five hundredths of an inch in hard steel, or it may elongate two tenths of an inch in soft steel. That is about the range, from 5 per cent. to 20 per cent., which we commonly meet in structural material.

*Mr. James E. Howard, Engineer of Tests, Watertown Arsenal, before New England R. R. Club.

"Under repeated stresses the aggregate elastic extensions may reach a total distance of three miles. From this point of view, the question of demanding a few hundredths of an inch elongation, more or less, in the specifications, is not a very impressive affair.

"Here is a piece of a wrought iron axle, taken from the inner end of the journal. It contains a crack in process of development. Examination with a pocket-magnifier will show a fine, slightly wavy crack at the fillet on the lower section of the piece, which was the inner end of the journal. This crack has penetrated to a depth of three hundredths to five hundredths of an inch below the surface. It is a progressive fracture in its early stages of development. Inasmuch as this type of fracture frequently reaches a considerable depth before the journal finally breaks off, it is taken to signify that occasional stresses of exceptional severity are received, much above the usual load on the journal. If the magnitude of the stress was constant and maintained at its maximum value, a few hundred rotations of the axle, after a crack had begun to develop, would terminate in the complete destruction of the journal.

"This approach to the limit of endurance of the axle is not characterized by any change in its outward appearance, nor by any change in the structure of the metal which has been detected, by means of which impending rupture may be recognized. Such knowledge depends upon previously obtained data concerning the tensile properties of the metal and experimental research upon the effect of repeated stresses similar to those which are received in service. An examination of the micro-structure of the metal of this axle showed a well-defined cellular network, across which the crack traversed. The direction of its course and position with reference to the meshes was apparently uninfluenced by the micro-structure.

"The micro-structure of other material has also been examined after long continued stresses, which had ended in the complete rupture of the metal.

"No change in the micro-structure was detected in that part of a steel shaft which had endured 150,000,000 repetitions of load under the maximum stress, which had ruptured the shaft, and other portions near the neutral axis, where practically no straining of the metal had occurred. These remarks refer to the results of repeated stresses in the vicinity of the elastic limit of the steel, which have been found competent to cause rupture without appreciable elongation of the metal. Axle fractures generally belong to this class, in which rupture is accomplished in all grades of metal, irrespective of their primitive toughness, with little or no elongation. It seems paradoxical that the ability of the metal to stretch may be distroyed without calling that property into action. Such, how-

ever, is the result of repeated alternate stresses which approach in magnitude the elastic limit of the metal. Lowering the stress prolongs the life of the material, and it seems reasonable to suppose that certain loads might be repeated indefinitely without causing rupture. If, on the other hand, the metal is overstrained by a load which causes permanent set, the place of ultimate rupture may be localized. This is seen in the fractures of coupling links."

The following are practical specifications for iron and steel axles:

SPECIFICATIONS FOR CAR AXLES.

IRON AXLES.

Iron axles must be made from No. 1 wrought iron scrap.

If made entirely under the hammer, the slabs or "shingles" must be cut in two pieces near the center, folded together, reheated and drawn out into a slab a second time before piling for the axle. The slabs must be of such size that a pile of three slabs is required to make one axle.

If made partly by rolling and partly under the hammer, the rolled bars must be over one inch thick when piled for the axle.

Each iron axle must be plainly stamped on one end with the word "iron." The maker's name or initials and the mark of the hammerman who makes it must also be stamped upon each axle.

Iron axles when offered for inspection must be piled in lots of 101 in such a manner that each axle may be examined by the inspector.

For each 100 iron axles, or fraction thereof, ordered, one additional axle must be furnished for test. This axle will be selected at random from the pile by a representative of the railway company and subjected to the prescribed drop test for iron axles. If it stands the test the 100 it represents will be inspected and only those accepted that are made in a workmanlike manner and are free from defects of all kinds.

Iron axles 4¼" in diameter at the center must stand, without fracture, 5 blows of a 1,640 pound weight falling 16 feet and striking the center of the axle midway between iron supports three feet apart; the axle to be turned over after each blow. The height of the drop test to be increased one foot for every ⅛ inch increase in the diameter of the axle at the center above 4¼ inches.

STEEL AXLES.

Steel axles must be made of open hearth steel.

As many steel axles as possible must be made from each melt.

The results of the chemical analyses, made at the steel works, of the melts used to fill the orders must be furnished the inspector when requested.

Each steel axle must be plainly stamped on one end with the word "Steel." The maker's name, or initials, the number of the melt from which it was made and the mark of the hammerman who made it must also be stamped on each axle.

Steel axles when offered for inspection must be piled according to melts so that all the axles from each melt are piled together.

From every melt used to fill an order for steel axles one axle will be selected at random by a representative of the railway company and subjected to the prescribed drop test for steel axles. If this axle stands the test all the axles from the heat it represents will be inspected and only those accepted that are free from surface defects of all kinds.

Steel axles 4¼ inches in diameter at the center must stand without fracture, 5 blows of a 1,640 pound weight falling 23 feet and striking the center of the axle midway between iron supports three feet apart; the axle to be turned over after each blow. The height of the drop to be increased one foot for every ⅛ inch increase in the diameter of the axle at the center above 4¼ inches.

ALL AXLES.

All axles must conform to the dimensions shown.

All axles must be cut to exact length and be centered with 60 degree centers.

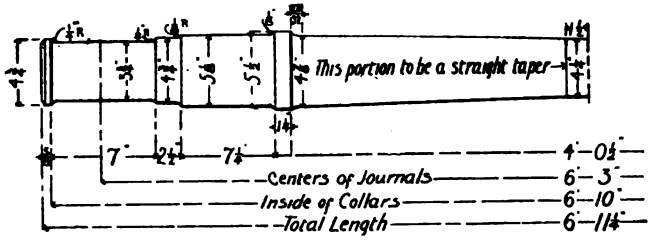
All finished axles must not show cracks, unwelded seams or defects of any kind.

All axles will be inspected and tested at the works where they are made. The manufacturer must notify the proper official of the Railway Company at least two days before the axles will be ready for inspection and must furnish, free of cost, test axles, testing apparatus and assistance necessary to make satisfactory inspection and tests. If the proper official prefers to test and inspect axles after they reach their destination, the manufacturer will be notified to ship them with the understanding that if they fail to meet the requirements of these specifications they will be rejected and returned at the expense of the manufacturer.

The specifications for iron and steel axles recommended by the Master Car Builders' Association are as follows:

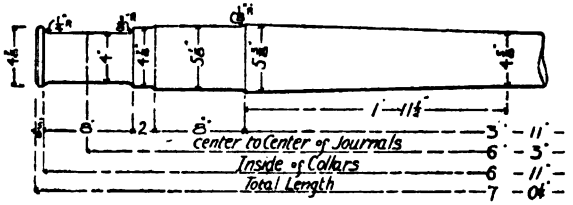
1. All axles must conform in shape and size to the dimensions shown in the blue prints which will be furnished by the —— R. R. Company.

Fig. 62



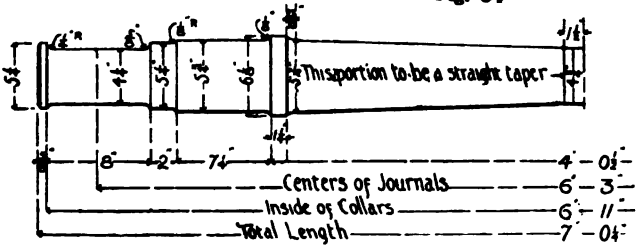
CAR AXLE.—CARS 40,000 LBS. CAPACITY OR LESS.

Fig. 63



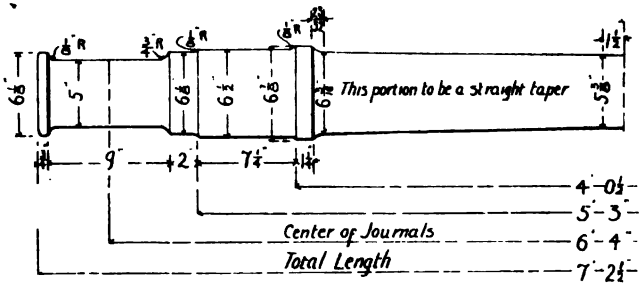
CAR AXLE.—CARS 50,000 LBS. CAPACITY.

Fig. 64



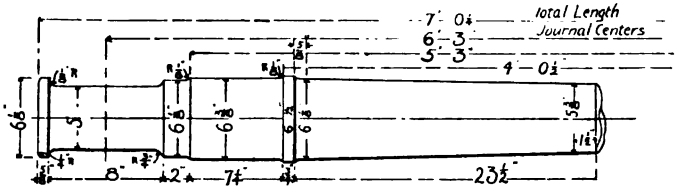
CAR AXLE.—CARS 60,000 LBS. CAPACITY.

Fig. 65



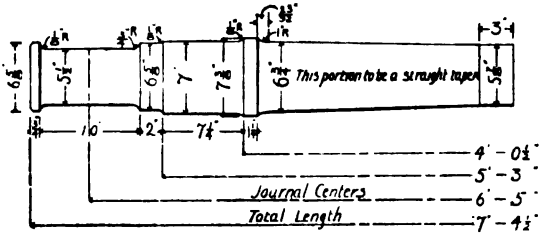
CAR AXLE.—CARS 80,000 TO 100,000 LBS. CAPACITY.

Fig. 66



CAR AXLE.—PASSENGER CARS.

Fig. 67



CAR AXLE.—CARS 100,000 TO 120,000 LBS. CAPACITY.

2. All axles must be cut off and faced to exact lengths, and to be centered with 60 degree centers in the manner indicated in blue prints, so as to prevent lathe centers from bottoming. Axles must be made of double-work fagoted scrap, 16 per cent. of new bar iron worked into the center of the axles being allowed if desired. Axles must be well hammered and free from any clearly defined open seams. They must finish in the lathe with journal free from flaws in the shape of holes, pieces shelled out, or open seams large enough, so that with a knife blade scale or dirt can be removed from such seams or open seams showing a clear opening of one thirty-second inch or over, and being more than 1 inch long. The maker's name or initials must be stamped plainly on each axle.

3. All axles are to be inspected and tested at the works where they are made. The ——— shall be notified when they are ready for inspection. Under no circumstances shall car axles be shipped from the works where they are made until they have been tested, inspected and accepted by a proper representative of the company.

4. For each one hundred axles or fraction thereof ordered, one additional axle must be furnished for test. This axle will be selected at random from the pile, and subjected to the prescribed drop test for iron axles of its class. If it stands the test the one hundred axles or fractional part thereof that it represents, will be inspected, and only those accepted that are made in a workmanlike manner and are free from defects mentioned in these specifications. All axles received are subject to rejection if they do not finish in the lathe in accordance with the requirements herein given. The manufacturer must furnish, free of charge, the axles that are to be tested, the testing apparatus, and the assistance necessary to enable the inspector to make a satisfactory inspection and test. Axles will not be accepted if the diameters fall below the dimensions for forged sizes given in the blue prints, or if exceeding those dimensions by more than ⅛ inch. Car axles in the rough must not have less than the prescribed minimum weight, nor more than the prescribed maximum weight for axles of their class.

AXLE DROP TEST.

5. All axles will be tested physically by drop test. The testing machine must conform in its essential parts to the drawings adopted by the Master Car Builders' Association. These essential parts are: The points of supports on which the axle rests during tests must be three (3) feet apart from center to center; the tup must weigh 1,640 pounds; the anvil which is supported on springs, must weigh 17,500 pounds; it must be free to move in a vertical direction; the springs

upon which it rests must be twelve in number, of the kind described on drawing, and the radius of the supports and of the striking face on the tup in the direction of the axis of the axle must be five (5) inches. When an axle is tested it must be so placed in the machine that the tup will strike it midway between the ends, and it must be turned over after the first and third blows, and when required after the fifth blow. After the first blow the deflection of the axle under test will be measured in the manner specified below.

6. It is desired that the axles when tested as specified above shall stand the number of blows at the heights specified in the following table without rupture, and without exceeding, as the result of the first blow, the deflections given.

Axle.	No. Blows.	Height of Drop.	Deflection.
M. C. B., 4¼ by 8 inch journals....	5	21½ ft.	7⅛ in.
M. C. B., 5 by 9 inch journals.....	5	29 ft.	$6^{1}/_{16}$ in.
M. C. B., 5½ by 10 inch journals...	5	36 ft.	$5^{7}/_{16}$ in.

7. Axles will be considered as having failed on drop test and will be rejected if they rupture or fracture in any way, or if the deflection resulting from the first blow exceeds the following:

M. C. B. axle, 4¼ by 8 inch journals.....8⅛ inches.
M. C. B. axle, 5 by 9 inch journals .....$8^{1}/_{16}$ inches.
M. C. B. axle, 5½ by 10 inch journals .....$6^{1}/_{16}$ inches.

In order to measure the deflection, prepare a straightedge as long as the axle by reinforcing it on one side, equally at each end, so that when it is laid on the axles the reinforced parts will rest on the collars of the axle, and the balance of the straightedge not touch the axle at any place. Next place the axle in position for test, lay the straightedge on it, and measure the distance from the straightedge to the axle at the middle point of the latter. Then, after the first blow, place the straightedge on the now bent axle in the same manner as before, and measure the distance from it to that side of the axle next to the straightedge at the point farthest away from the latter. The difference of the two measurements is the deflection.

SPECIFICATIONS FOR STEEL AXLES.

1. Axles will be ordered not less than 100 on one order. All axles must be made and finished in a workmanlike manner, and must be free from cracks, or seams, or flaws which can be detected by the eye. All parts must be rough turned, except on point "A" on diagram.

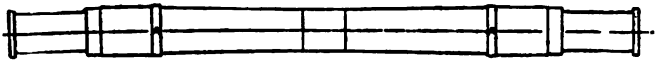
2. All axles must be made of steel, and the material desired have the following composition:

Carbon	0.40 per cent.
Manganese, not above	0.50 per cent.
Silicon	0.05 per cent.
Phosphorus, not above	0.05 per cent.
Sulphur, not above	0.04 per cent.

3. All axles must conform in sizes, shapes and limiting weights to the requirements given on the order or print sent with it. The rough turning must be done with a tool so shaped as to leave the surface free from ridges; and in centering them 60-degree centers must be used with proper clearance for lathe centers. All axles must be legibly stamped when offered for test, on the unfinished portion, "A" on diagram with the blow or heat number and the date, and on the cylindrical portion at center they must be stamped with the name of the maker.

Portions marked "A" to be unfinished and to have stamped upon either of them blow number and date.

Fig. 68



CAR AXLE.—STEEL.

4. Manufacturers must notify ——— when they are ready to ship not less than 100 axles; must have all the axles made from each heat, and no others in a pile by themselves; must furnish the testing machine referred to in Section 6, and the proper appliances for checking the dimensions and weights; must have a car or cars ready to receive shipment; must furnish the labor and power necessary to enable the inspector to promptly inspect and test; and ship or store the axles when tests are finished. Axles which, when offered for test, are so rusty as to hide defects will not be considered.

5. A shipment of axles being ready for test, the inspector will first make a list of the heat numbers in the various piles of axles offered, and the number of axles bearing the same heat number in each pile. If he finds in any pile axles bearing different heat numbers he must, before going further, have the pile rearranged, so that only those axles having the same heat number will be in the same pile. Also, if he finds in any

pile any axles having evidence of changed or defaced heat numbers, or any axles having heat numbers not clearly legible, or any bearing heat numbers previously rejected, he will exclude such axles from further consideration. He will then examine the axles in each pile or heat, as to workmanship and defects visible to the eye, and as to whether they conform to dimensions and directions on the order, or tracing, or in these specifications. All axles not satisfactory in these respects must be laid aside and will not be further considered. This being done, if less than thirty axles in any heat are left, he will refuse to consider that heat further. If in this inspection defects are found which the manufacturer can remedy while the inspector is at the works, he may allow such defects to be cured and may count the axles which are successfully treated in this way as a part of the thirty above mentioned. Not less than thirty axles from any one heat having passed the foregoing inspection, the inspector will select from each pile or heat, one axle at random, and subject it to the physical test prescribed for such axles as may be under consideration. If the test axle fails to fill the physical requirements, all the axles from that heat of steel will be regarded as rejected, and none of them will at any time be considered again. If the test axle passes physical test, the inspector will draw a straight line parallel with the axis of this test axle ten (10) inches long, starting from one end of it, and prick-punch this line at several points. He will then have a piece about six (6) inches long cut off from the same axle, so as to leave some of the prick-punch marks on each piece of the axle. The 6-inch piece must be sent at once, properly tagged to ———. The piles of axles which have passed physical test will be allowed to remain as the inspector leaves them, until the results of the chemical test are known. The 6-inch piece being received at the laboratory, a line will be drawn from the prick-punch line above described, through the center of the axle across the cut-off end, and a prick-punch mark made on this last line, 40 per cent of the distance from the center to the circumference of the axle. Borings for analysis will be taken by means of a $\frac{5}{8}$ inch diameter drill, acting parallel to the axis of the axle, and starting with its center in the last described prick-punch mark. The borings will be analyzed in accordance with standard methods, and the results of analysis will be communicated to the inspector, who will at once proceed to the works, and reject or accept and ship, or mark and store, as the case may be, the axles in question. If the analysis of any test axle shows that the steel does not meet the chemical requirements, all of the axles of that heat will be regarded as rejected, and none of them will at any time be considered again. If the analysis of any test axle shows that the steel meets the chemical requirements, all of the axles

of that heat which have passed inspection and physical test will be regarded as accepted. The inspector will proceed to load and ship from the accepted axles as many as may be required to fill the order. If, as the result of inspection and the physical and chemical tests, more axles are accepted than the order calls for, such accepted axles in excess will be stamped by the inspector with his own name, and will then be piled and allowed to remain at the works, subject to further orders from the purchasing agent. On receipt of further orders, axles once accepted will, of course, not be subject to further test, but in no case will even accepted axles be loaded and shipped except in the presence of the inspector. In all cases the inspector will keep an accurate record of the heat numbers, of the number of axles in each heat which are rejected, or stored, and will transmit this information with each report.

6. All axles will be tested physically by drop test. The testing machine must conform in its essential parts to the drawings adopted by the Master Car Builders' Association. These essential parts are: The points of supports on which the axle rests during tests must be three feet apart from center to center; the tup must weigh 1,640 pounds; the anvil, which is supported on springs, must weigh 17,500 pounds; it must be free to move in a vertical direction; the springs upon which it rests must be twelve in number, of the kind described on drawing; and the radius of supports and of the striking face on the tup in the direction of the axis of the axle must be five (5) inches. When an axle is tested it must be so placed in the machine that the tup will strike it midway between the ends, and it must be turned over after the first and third blows, and when required, after the fifth blow. After the first blow, the deflection of the axle under test will be measured in the manner specified below.

7. It is desired that the axles, when tested under the drop test as specified above, shall stand the number of blows at the height specified in the following table without rupture and without exceeding as the result of the first blow the deflections given:

Axle.	No. Blows.	Height of Drop.	Deflection.
M. C. B. 4¼ by 8 inch journals for 60,000-pound cars	5	34 feet	7 inches
M. C. B. 5 by 9 inch journals for 80,000 pound cars	5	43 feet	5¾ inches
M. C. B. 5½ by 10 inch journals for 100,000-pound cars	7	43 feet	4 inches

8. Axles will be considered as having failed on physical test and will be rejected if they rupture or fracture in any way,

or if the deflection resulting from the first blow exceeds the following:

M. C. B. axle, 4¼ by 8 inch journals .....7⅛ inches
M. C. B. axle, 5 by 9 inch journals .....6¼ inches
M. C. B. axle, 5½ by 10 inch journals .....4½ inches

9. Axles will be considered to have failed on chemical test and will be rejected if the analysis of the borings taken as above described gives figures for the various constituents below, outside the following limits, namely:

Carbon ....below 0.35 per cent., or above 0.50 per ient
Manganese ..... above 0.60 per cent. .
Phosphorus ..... above 0.07 per cent.

In order to measure the deflection, prepare a straightedge as long as the axle, by reinforcing it on one side, equally at each end, so that when it is laid on the axle, the reinforced parts will rest on the collars of the axle, and the balance of the straightedge not touch the axle at any place. Next place the axle in position for test, lay the straightedge on it and measure the distance from the straightedge to the axle at the middle point of the latter. Then, after the first blow, place the straightedge on the now bent axle in the same manner as before, and measure the distance from it to that side of the axle next to the straightedge at the point farthest away from the latter. The difference in the two measurements is the deflection.

The following illustration (Figure 69) shows the Master Car Builders' standard axles, wheel tread and flange, and circumference measure; all of which have been referred to in the several specifications given:

Journal Boxes.—These are the boxes (Plate II., No. 35) which enclose the journals of car axles, the journal bearing and key and which hold the packing for lubricating the journal. They are sometimes called axle boxes, grease boxes, oil housings, oil boxes or pedestal boxes.

In Figures 70 to 81 inclusive are illustrations of standard journal boxes and contained parts and standard bearings, wedges and lids as adopted by

BEARING
CURVE OF
BEARING

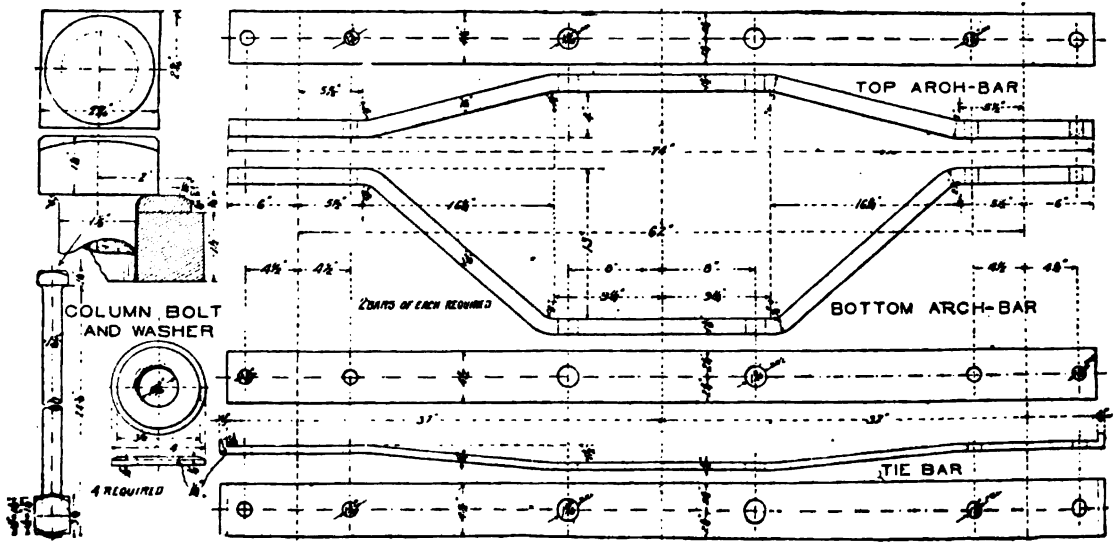
the Master Car Builders' Association. Numerous specially designed boxes are in general use which are intended to improve small details of the boxes. However, in all the essential dimensions, as shown in these figures, these special boxes are perfectly interchangeable with boxes made strictly on the lines of the M. C. B. designs. Figure 82 shows the gauges for the several sizes of journal bearings and wedges.

Arch Bars and Tie Bars.—As illustrated elsewhere herein the truck sides are often constructed of commercial or specially shaped bars. Pressed plates, channel bars and I beams are variously formed to make the different patented truck sides. The simplest and most common style is made up of rectangular bar iron into the "Diamond Frame" design. Each side is composed of three bars: the two which rest on top of the journal box being the "arch bars" (Plate II., Nos. 31, 32), the single one which holds the bottom of the journal boxes in place being known as the "tie bar" (Plate II., No. 33). The bar which passes over the top of the column casting (Plate II., No. 14) is the top arch bar, while the one which goes under the casting is called the "bottom" or "inverted" arch bar. The whole construction is held solidly together by the column bolts (Plate II., No. 34) and the journal box bolts (Plate II., No. 37).

The Master Car Builders' Association has adopted as standard a design of arch bars, tie bar and column bolts for 80,000 lbs. capacity cars as shown in Figure 83.

Bolster, Spring Plank and Truck Transoms.—The truck bolster (Plate II., No. 38) is the beam which takes the load of the car at its center and

Fig. 83



ARCH BARS AND COLUMN BOLT.—80,000 LBS. CAPACITY CARS.

transmits it to the springs under its ends. With a rigid form of truck the load is then passed through the spring plank directly to the arch bars or truck sides. However, with a swing motion truck the spring plank is suspended by hangers from the transoms through which the load is transmitted to the truck sides.

The bolster is now almost universally made of iron or steel, although a great many are still in service which are of wood or alternate layers of iron and wood. In the construction of bolsters, spring planks and transoms, standard forms of channel bars and I beams are usually used. There are also a number of special channel bars, known as "Truck Channels." Steel castings also are in common use for these parts.

The following are practical specifications of Car Truck Channels:

SPECIFICATIONS FOR STEEL CAR TRUCK CHANNELS.

All steel car truck channels purchased by or used in the construction of new cars for the ——— company must meet the requirements of the following specifications:

1. The steel must be made by the open hearth process.
2. The melt number must be plainly stamped on each channel.
3. The sizes and shapes must conform to the drawings shown on the following pages of these specifications.
4. All channels must be straight and free from cracks, flaws and defects of all kinds.
5. From each melt of steel used to fill the order one channel will be selected by the railway company's representative for test.

From the web of this test channel a test piece will be cut 2 inches wide by 20 inches long and the thickness of the channel as rolled.

This test piece when subjected to a tensile test must show:

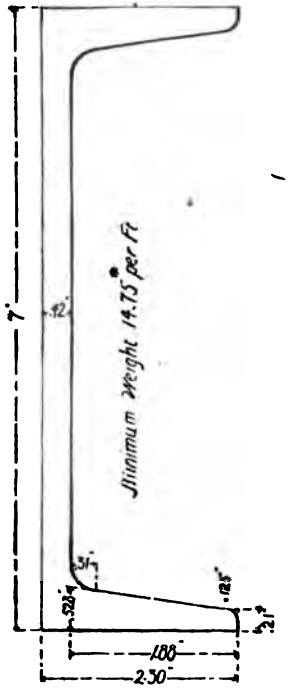
Tensile strength per square inch..48,000 to 58,000 lbs.
Elongation in 8 inches not less than ...25 per cent.
Reduction of area not less than .....40 per cent.

6. The chemical analysis of each melt of steel used to fill the order must be furnished by the manufacturer of the steel.

7. The name or initials of the manufacturers must be plainly rolled or stamped on each channel.

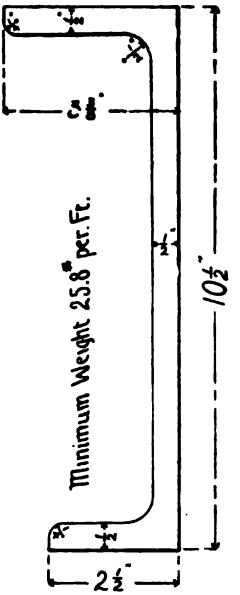
8. Car truck channels will be inspected and tested at the works where they are made.

Fig. 84



SECTION OF FREIGHT CAR TRUCK CHANNEL.

Fig. 85

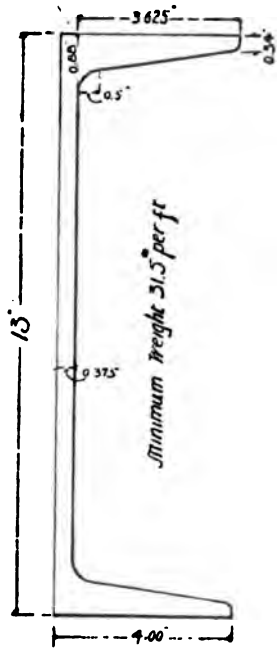


SECTION OF FREIGHT CAR TRUCK CHANNEL.—OLD STYLE.

The manufacturers must notify the proper official of the railway company at least two days before the channels will be ready for inspection and they must furnish, free of cost, the test pieces, the testing apparatus and assistance necessary

to make satisfactory inspection and tests. When small quantities are ordered or for any other reason, if the engineer of tests prefers to test and inspect the channels after they reach their destination, he will notify the manufacturers to ship them with the understanding that if they fail to meet the requirements of these specifications they will be rejected and returned at the expense of the manufacturers.

Fig. 86



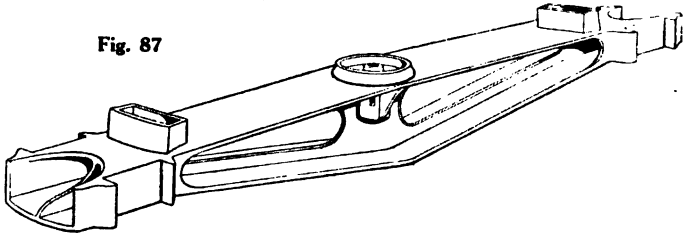
SECTION OF FREIGHT CAR TRUCK CHANNEL.

Special makes and types of bolsters are shown in Figures 87, 88 and 89. Figure 87 shows a cast steel bolster designed for a rigid truck. It is of course rather open in section to reduce the weight and

also place the material just where it is desired so as to properly carry the load. Figures 88 and 89 illustrate the Simplex and the Betterdorf bolsters which are both of the built-up style, the former using a channel bar with special castings and a wrought iron plate as the tension member, while the latter is composed of I beams specially shaped which are held together by wrought iron plates.

Springs.—These are known variously as "truck springs," "bolster springs," "bearing springs" and "body springs." The helical or spiral springs

Fig. 87



COMMONWEALTH TRUCK BOLSTER.

is the kind commonly used for freight cars. Elliptical springs are occasionally used for caboose car trucks and are invariably used for passenger trucks.

The following are specifications for helical springs for trucks of various capacities. They include also helical springs used for various other purposes on both freight and passenger cars.

SPECIFICATIONS FOR HELICAL SPRINGS FOR CARS.

All helical springs for cars purchased by or used in the construction of new cars for this company must meet the requirements of the following specifications:

Helical springs will be designated by the letters indicating the classes to which they belong.

The workmanship of these springs must be first class in every particular, special attention being paid to the uniformity of the pitch.

The weights of the finished springs must not vary more than two per cent. (2%) from the specified weights.

The heights of the finished springs must not vary more than one-eighth of an inch from the specified heights.

When tested to their full capacity springs must not take any permanent set.

When tested to their full capacity springs must close evenly at all points.

In double coil springs both coils should exhaust at the same time. In no case will springs be accepted if the inside coil exhausts first.

Each spring must have the letter designating its class, the maker's mark and the date when made stamped near one end.

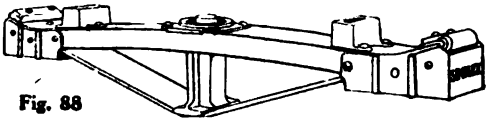


Fig. 88

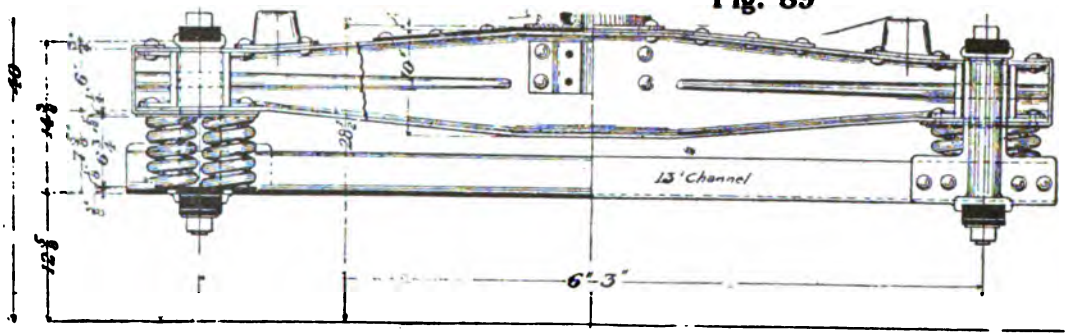
SIMPLEX TRUCK BOLSTER.

Springs of each class must conform to the detail specifications and drawings of that class.

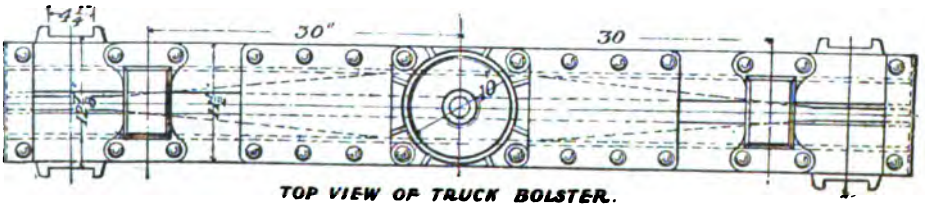
Helical springs will be inspected and tested at the works where they are made. The manufacturer must notify the proper official of the railway company at least two days before the springs will be ready for inspection and must furnish, free of cost, test springs, testing apparatus and assistance necessary to make satisfactory inspection and tests. If railway company prefers to test and inspect the springs after they reach their destination, the manufacturer will be notified to ship them with the understanding that if they fail to meet the requirements of these specifications they will be rejected and returned at the expense of the manufacturer.

The Master Car Builders' Association has adopted as recommended practice designs of springs and spring caps for freight car trucks shown in Figure 96.

Fig. 89



ELEVATION TRUCK BOLSTER.



TOP VIEW OF TRUCK BOLSTER.

BETTERDORF TRUCK BOLSTER.

HELICAL SPRINGS

DETAIL SPECIFICATIONS.	CLASS A Equalizer Spring for 6 wheel truck, weight of car body 46,000 to 48,000 lbs.	CLASS B Equalizer Spring for 6 wheel truck, wt. of car body 48,000 to 66,000 lbs. For weights between 66,000 and 75,000 lbs. use Spring Class O as 2d coil.	CLASS C Equalizer Springs for 4 wheel truck, weight of car body 24,000 to 32,000 lbs.	CLASS D Equalizer Spring for 4 wheel truck of way cars.	CLASS E Bolster Spring for Freight cars, 30,000 to 40,000 lbs. capacity.
No. of coils in each spring	2	2	2	1	2
Weight of entire spring	50¾ lbs.	53½ lbs.	44 lbs.	16 lbs.	24 lbs.
Weight of outside coil	32¾ "	35¾ "	32¼ "	16 "	17¾ "
Weight of inside coil	18 "	17¾ "	11¾ "	.....	6¼ "
Diameter of outside coil	8 in.	8 in.	7 in.	5¾ in.	6 in.
Diameter of inside coil	5⅝ "	5⅜ "	4⅝ "	.....	3⅝ "
Size of bar outside coil	1⅛ "	1¼ "	1¼ "	1 "	1⅛ "
Size of bar inside coil	⅛ "	1 "	¾ "	.....	⅛ "
Height of entire spring, free	9¾ "	9¾ "	10 "	7½ "	6¾ "
Height of entire spring under given load	8 in. under 6,500 lbs.	8 in. under 8,200 lbs.	8¼ in. under 5,800 lbs.	6½ in. under 3,000 lbs.	5¾ in. under 8,000 lbs.
Height of entire spring, closed	6¼ in.	6¼ in.	6⅝ in.	5 in.	5 in.
Motion of entire spring to be not less than	3 in.	3 "	3⅜ "	2½ "	1¾ "
Capacity of entire spring to be not less than	14,000 lbs.	20,000 lbs.	18,000 lbs.	10,000 lbs.	16,000 lbs.
Kind of steel to be used	Open hearth	Open hearth	Open hearth	Open hearth	Open hearth
Thickness of top and bottom malleable iron plates	No plates	No plates	No plates	No plates	No plates
Each spring to be stamped with letter	A	B	C	D	E

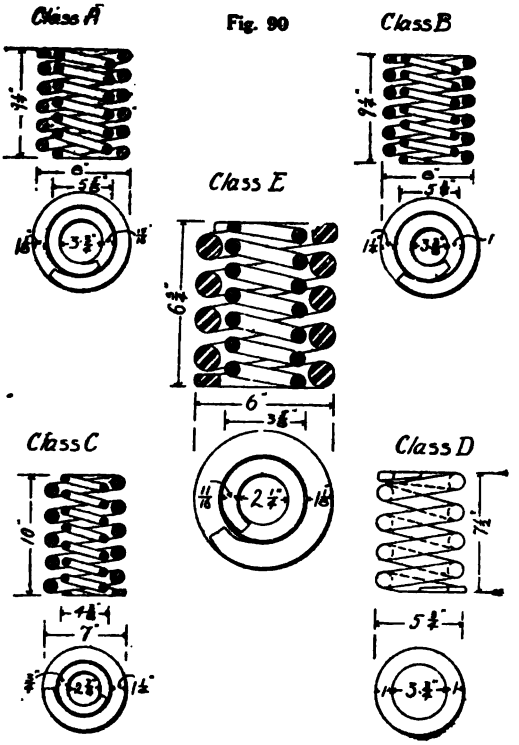
HELICAL SPRINGS

DETAIL SPECIFICATIONS.	CLASS F Bolster Spring for freight cars with iron trucks 40,000 to 50,000 lbs. capacity.	CLASS G Draw-bar Springs for freight cars, with 1⅛ in. follower plates.	CLASS H Draw-bar Springs for freight cars, with 1 in. follower plates.	CLASS I Draw-bar and Buffer Springs for passenger and Buffer Springs for freight equipment.	CLASS J Bolster Springs for freight cars 50,000 to 60,000 lbs. capacity.
No. of coils in each spring	4	2	2	2	4
Weight of entire spring	69 lbs.	28 lbs.	33 lbs.	27 lbs.	75 lbs.
Weight of outside coil	13½ "	22 "	25¼ "	20¾ "	15 "
Weight of inside coil	.....	6 "	7¾ "	6¼ "	.....
Diameter of outside coil	5 in.	6 in.	6 in.	5½ in.	5¼ in.
Diameter of inside coil	.....	3⅜ "	3⅜ "	3⅛ "	.....
Size of bar outside coil	1 "	1¼ "	1¼ "	1⅛ "	1⅛ "
Size of bar inside coil	.....	⅞ "	⅞ "	⅝ "	.....
Height of entire spring, free	7 in. over plates	7 "	8 "	8 "	7 in. over plates
Height of entire spring under given load	6¾ in. over plates under 16,000 lbs.	.....	.....	.....	6¼ in. over plates under 16,000 lbs.
Height of entire spring, closed	5¾ in. over plates	5¼ "	6 "	6 "	5¾ in. over plates
Motion of entire spring to be not less than	1⅝ in.	1¾ "	2 "	2 "	1⅝ in.
Capacity of entire spring to be not less than	40,000 lbs.	18,000 lbs	20,000 lbs.	15,000 lbs.	44,000 lbs.
Kind of steel to be used	Open hearth	Open hearth	Open hearth	Open hearth	Open hearth
Thickness of top and bottom malleable iron plates	¼ in. each	No plates	No plates	No plates	¼ in. each
Each spring to be stamped with letter	F	G	H	I	J

HELICAL SPRINGS

DETAIL SPECIFICATIONS	CLASS K. Assigned to Spring for standard spring rail frog.	CLASS L. Platform Buffer Spring for passenger equipment.	CLASS M. Draw-bar Buffer Spring for passenger equipment.	CLASS N. Draw-bar Spring for passenger equipment.	CLASS O. Use as third coil with Class B spring for car body wts. between 60,000 and 75,000 lbs.
No. of coils in each spring	.....	1	2	2	1
Weight of entire spring	.....	3 lbs.	52½ lbs.	35¾ lbs.	6¼ lbs.
Weight of outside coil	.....	.....	39 "	26½ "	.....
Weight of inside coil	.....	.....	13½ "	9¼ "	.....
Diameter of outside coil	.....	2⅛ in.	6½ in.	6½ in.	3¼ in.
Diameter of inside coil	.....	.....	3⅛ "	3⅛ "	.....
Size of bar outside coil	.....	⅛ "	1¼ "	1¼ "	⅝ "
Size of bar inside coil	.....	.....	¾ "	¾ "	.....
Height of entire spring, free	.....	12 "	12 "	8 "	9¼ "
Height of entire spring under given load	.....	.....	.....	.....	8 in. under 1,200 lbs.
Height of entire spring, closed	.....	7⅜ "	9 "	6 "	6¼ in.
Motion of entire spring to be not less than	.....	4⅝ "	3 "	2 "	3 "
Capacity of entire spring to be not less than	.....	600 lbs.	18,000 lbs.	18,000 lbs.	.....
Kind of steel to be used	.....	Open hearth	Open hearth	Open hearth	Open hearth
Thickness of top and bottom malleable iron plates	.....	No plates	No plates	No plates	No plates
Each spring to be stamped with letter	.....	L	M	N	O

DETAIL SPECIFICATIONS.	CLASS P Overhead Equalizer Spring for vestibule cars.	CLASS Q Equalizer Spring for 6 wheel truck weight of car body.	CLASS R Overhead Equalizer Spring for vestibule cars.	CLASS S Side Buffer Spring for vestibule cars.	CLASS T Center Buffer Spring for vestibule cars.
No. of coils in each spring	1	3	1	1	2
Weight of entire spring					
Weight of outside coil					
Weight of center coil					
Weight of inside coil					
Diameter of outside coil	2½ in.	8 in.	2¼ in.	3 in.	5½ in.
Diameter of center coil		5⅜ "			
Diameter of inside coil		3¼ "			3⅝ "
Size of bar outside coil	$\frac{5}{16}$ "	1¼ "	$\frac{5}{16}$ "	½ "	⅝ "
Size of bar center coil		1 "			
Size of bar inside coil		⅝ "			⅝ "
Height of entire spring, free	20 "	10 "	18½ "	14¼ "	12 "
Height of entire spring, under given load					
Height of entire spring, closed					
Motion of entire spring to be not less than					
Capacity of entire spring to be not less than					
Kind of steel to be used					
Thickness of top and bottom malleable iron plates					
Each spring to be stamped with letter	P	Q	R	S	T


Class A
Fig. 90
Class B
Class E
Class C
Class D
HELICAL SPRINGS.

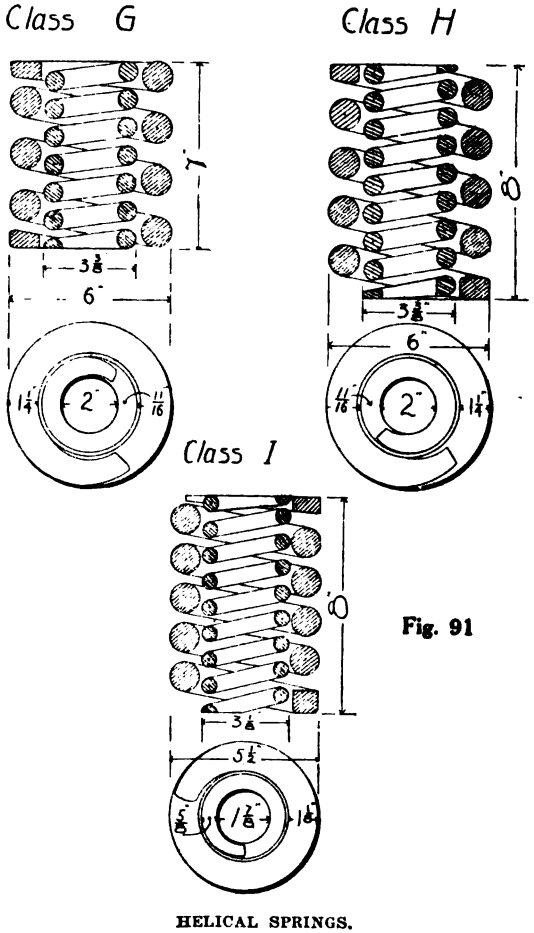
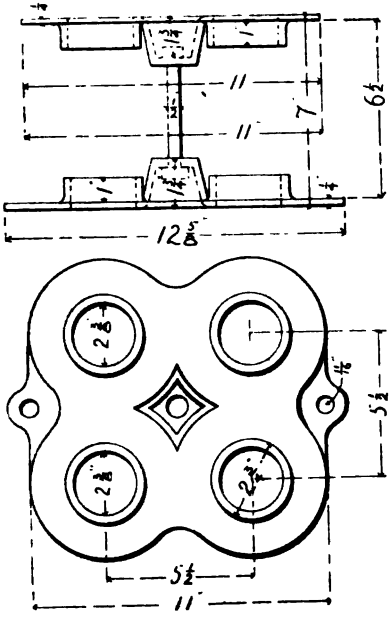


Fig. 91

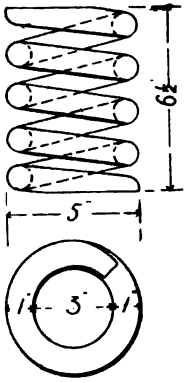
HELICAL SPRINGS.

Fig. 92

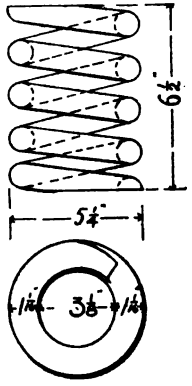
Plates for F & J



Class F.



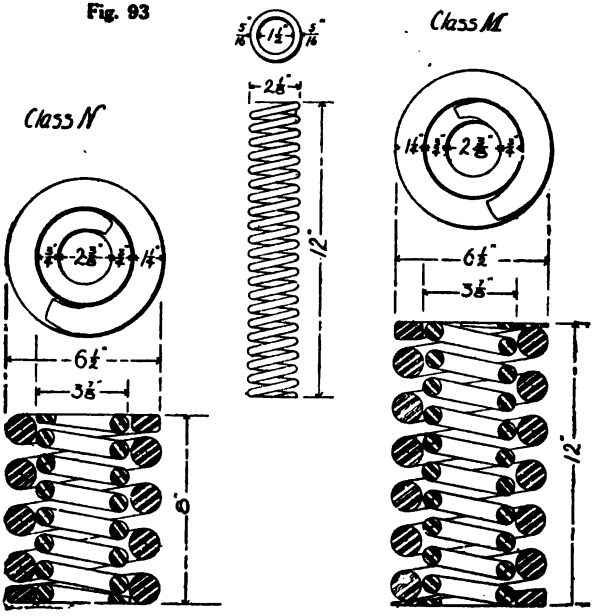
Class J



HELICAL SPRINGS.

Class L

Fig. 93



HELICAL SPRINGS.

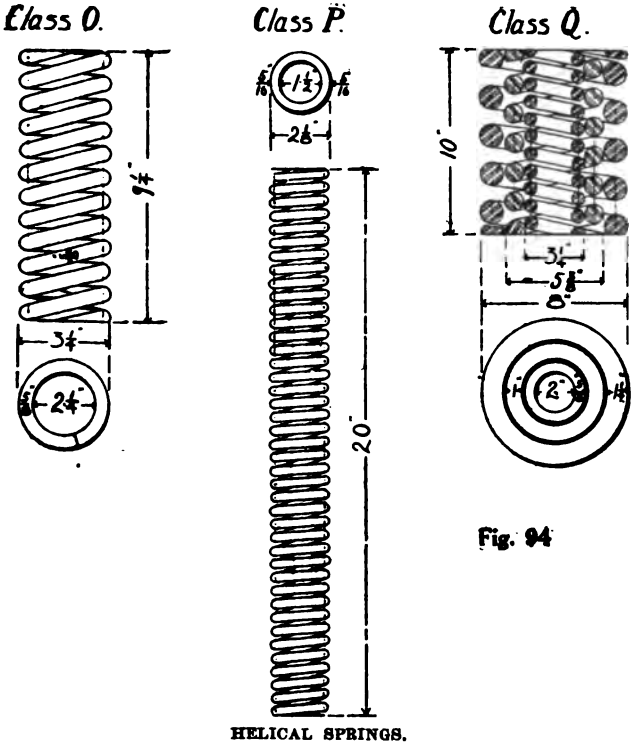


Fig. 94

HELICAL SPRINGS.

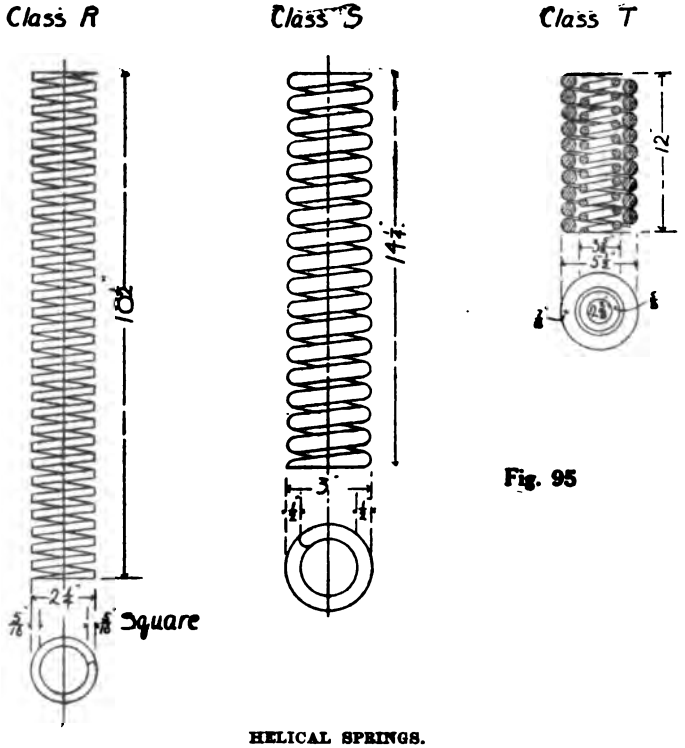


Fig. 95

HELICAL SPRINGS.

CHAPTER V.

THE FREIGHT CAR TRUCK—THE DIFFERENT TYPES.

The wheel, in conjunction with the motive power, may be said to be the essential thing in the art of transportation. It is the thing that makes locomotion possible.

One or two hewn circular logs beneath a wider plank was probably the first conception of the wheel, such vehicles being in fact in use before the dawn of Christianity. In the rounded log the wheel and axle were in one, but in process of time, and in order to minimize friction the axle was cut down. The wheel remained a solid piece of wood through the center of which the axle passed. Then the slab of wood forming the wheel was strengthened by cross bars, the axle became a part of the frame of the vehicle and the wheel alone was made to revolve.

The spoke, the felloe and the hub were the developments of ages, simple as they seem to us. It is remarkable that in one of the highest manifestations of the art of transportation it should transpire that a return to first principles should be made, for the modern car wheel and axle revolve in unison and the wheel disdains the felloe, the hub and the spoke, or possesses them only in rudimentary forms. Yet the wheel of the railway is strikingly distinctive from all forms that ever preceded it—the flange by which it is kept on the track, the conical tread designed partially to facil-

itate passing over curves and partially to keep the wheels central upon the rails, and the axle bearings outside the wheel so that the gauge of the track should not circumscribe the width of the vehicle, are its especial distinctions.

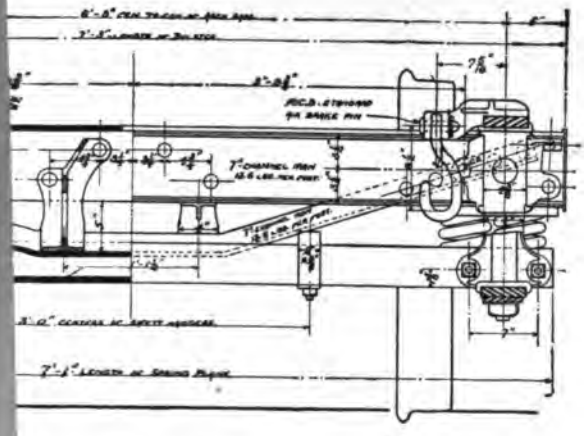
The word truck in one of its earlier meanings indicated simply a small wheel. By natural adaptation it came in time to include low vehicles used for the carriage of goods and in due season became the appellation for that part of the railway car which furnishes it with the means of movement. The car truck is in fact mechanically a small car of itself, with four or six wheels placed under each end of the car body and carrying its weight.*

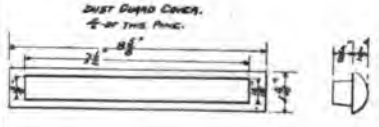
The car truck of the present day is, in common with other railway appliances, the result of evolution and may be said to have been brought into being by the exigencies of railroad construction in America. The object sought and attained is to enable short wheel-bases to be used in connection with long car bodies.

The American Freight Truck (Plate II.) consists of four wheels, two axles, four journal boxes and a frame in which these are guided or secured, this frame transferring the weight of the car and its load from its center through the boxes and journals to the wheels. The truck is center-bearing and connected only at one point with the car body, hence it is free to move around this point and adjust itself to any position demanded by the curvature of the track.

Freight car trucks may be classified according

*In England the word "truck" is never used in this connection, but is descriptive of the freight car as a whole. The truck there is known as a "bogie."





H FREIGHT TRUCK. 60,000 LBS. CAPACITY.

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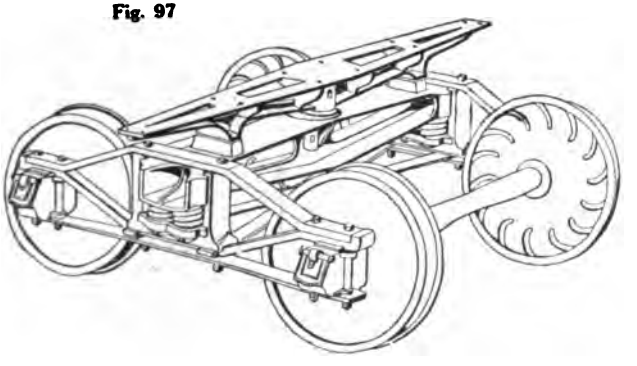
to the bolster suspension as (1) Rigid and (2) Swing Motion. According to their general design they may be classified as (1) Diamond Trucks and (2) Shaped Metal Trucks. Swing Motion Trucks may be further distinguished as (1) Those carrying the bolster by pivoted hangers and (2) those carrying the bolster by rollers. There are various special designs of each type.

Plate III. illustrates a type of the "Rigid" Diamond truck which is in common use. It will be noticed that this truck also has a channel iron spring plank, a practice which is very much in favor when the arch bar truck is used.

Fig. 97



COMMONWEALTH TRUCK.

Another arch bar rigid truck is shown in Figure 97, which illustrates one style of the Commonwealth Truck. This combines the standard arch bars with especially designed bolster and column castings. It is claimed for this truck that it has all the strength of the ordinary arch bar truck, is exceedingly flexible, easily following the irregularities of the track, and is light and strong.

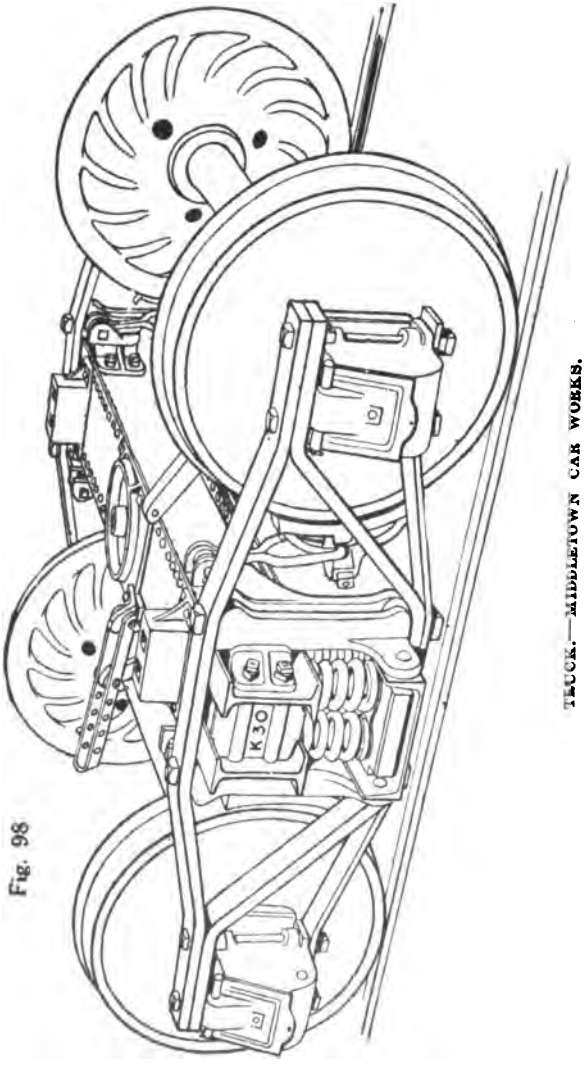


Fig. 98

TRUCK.—MIDDLETOWN CAR WORKS.

The truck shown in Figure 98, which is a design prepared by the Middletown Car Works, is another good example of the rigid arch bar truck. The special bolster which is provided is made up of standard sections as rolled by the American Iron and Steel Association, thus facilitating repairs in any part of the country. Another special feature shown here is the scheme for suspending the brake beams from inwardly projecting arms from the column castings.

Of the rigid shaped metal style of truck the Fox-Solid Pressed Steel truck shown in Figure 99 illustrates all the points. It is to be noted that the truck sides and bolster are all combined in one rigid construction. The springs, instead of being under the bolster are here placed in special recesses over the journal boxes.

The Pressed Steel truck frame shown in Figures 100 and 101 is of the Schoen patent type. This also is a perfectly rigid truck and has the same method for holding the springs as is used on the Fox truck.

In "Swing Motion" trucks the design is to allow a limited lateral motion in addition to the vertical motion on the springs so that the lateral movements of the wheels may be absorbed and not imparted to the car itself. The claim is made that the use of the Swing Motion truck results in decreased flange wear on wheels, reduces the racking of the car as a whole and makes the riding of the car easier. It is admitted, however, that on account of its simple construction the "Rigid" truck is cheaper to build and maintain. Trucks of this class are shown in the illustrations of the Schoen pressed steel Diamond Truck and the American

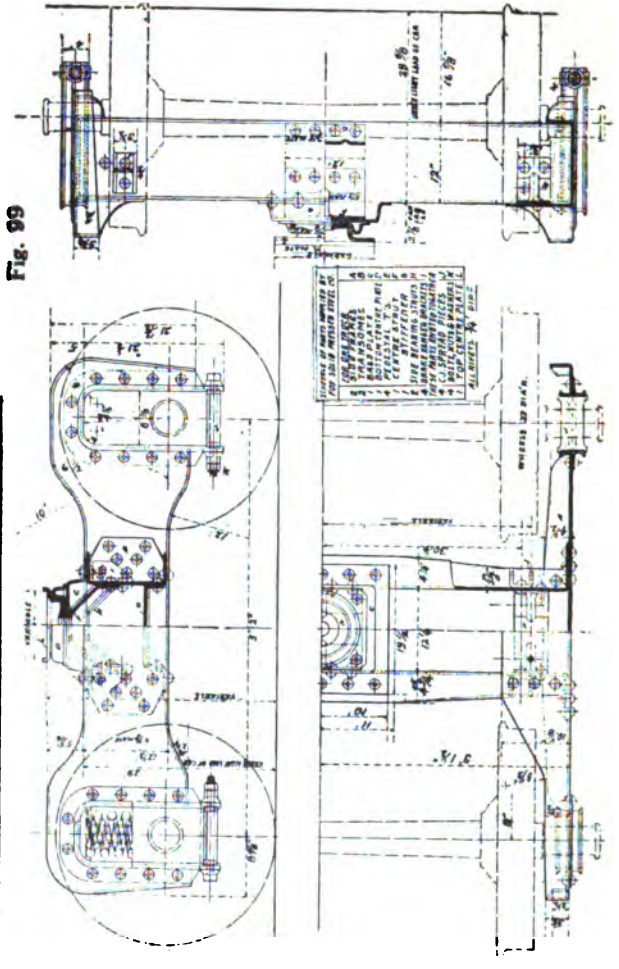


Fig. 99

FOX PATENT PRESSED STEEL FREIGHT CAR TRUCK

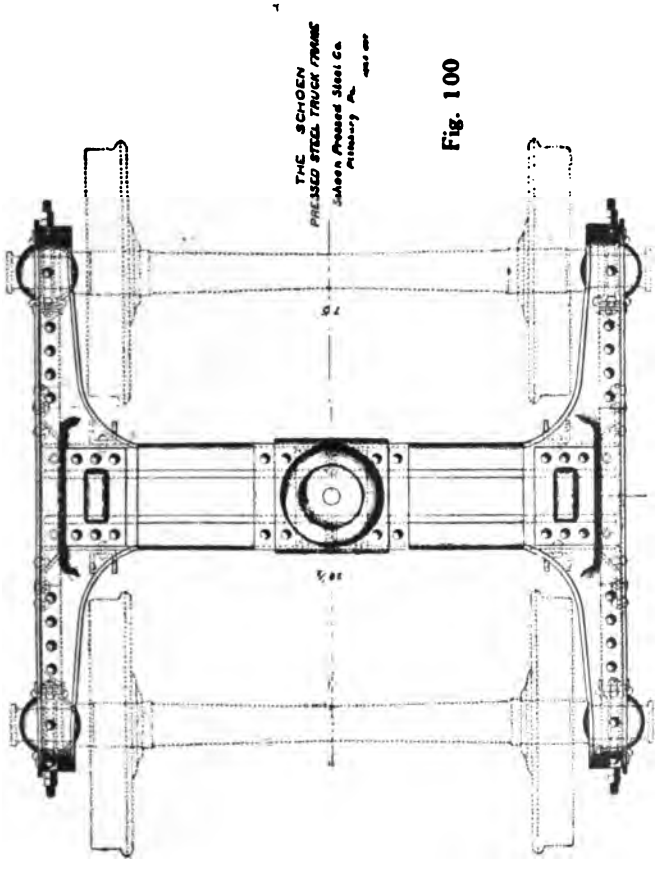


Fig. 100

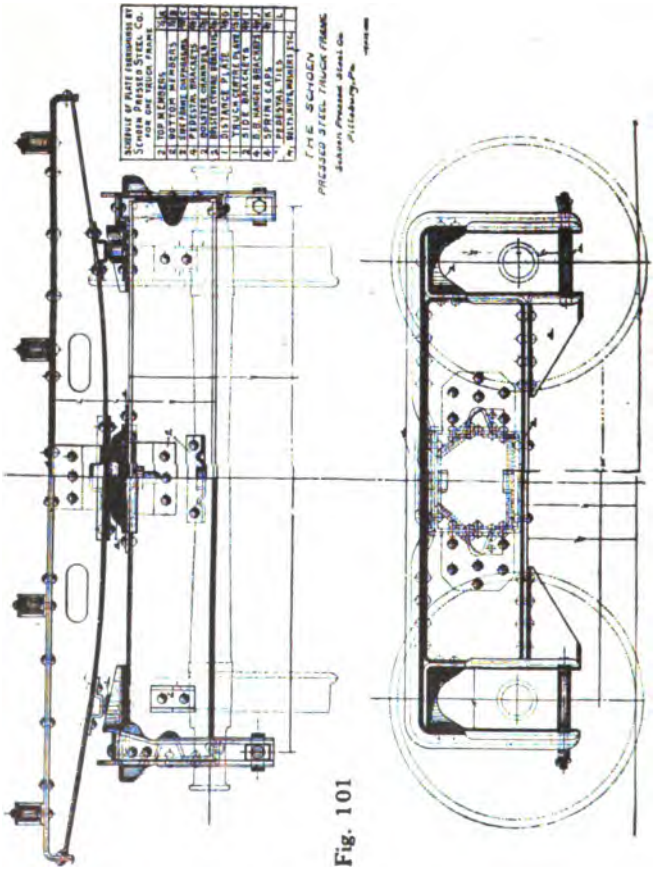


Fig. 101

Cast Steel Truck. (Figures 102, 103.) The drawing (Figure 104) illustrates the construction of a 30 ton Swing Motion Truck.

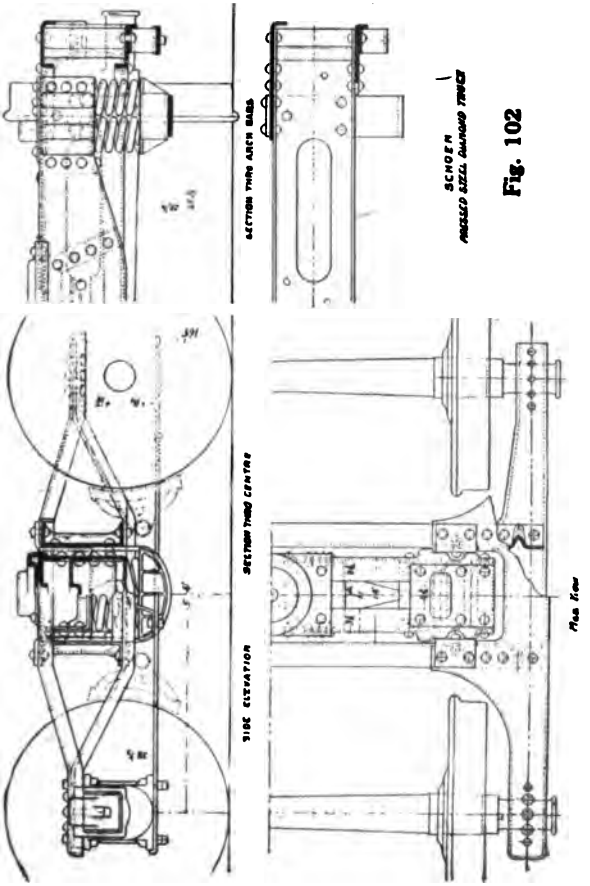


Fig. 102

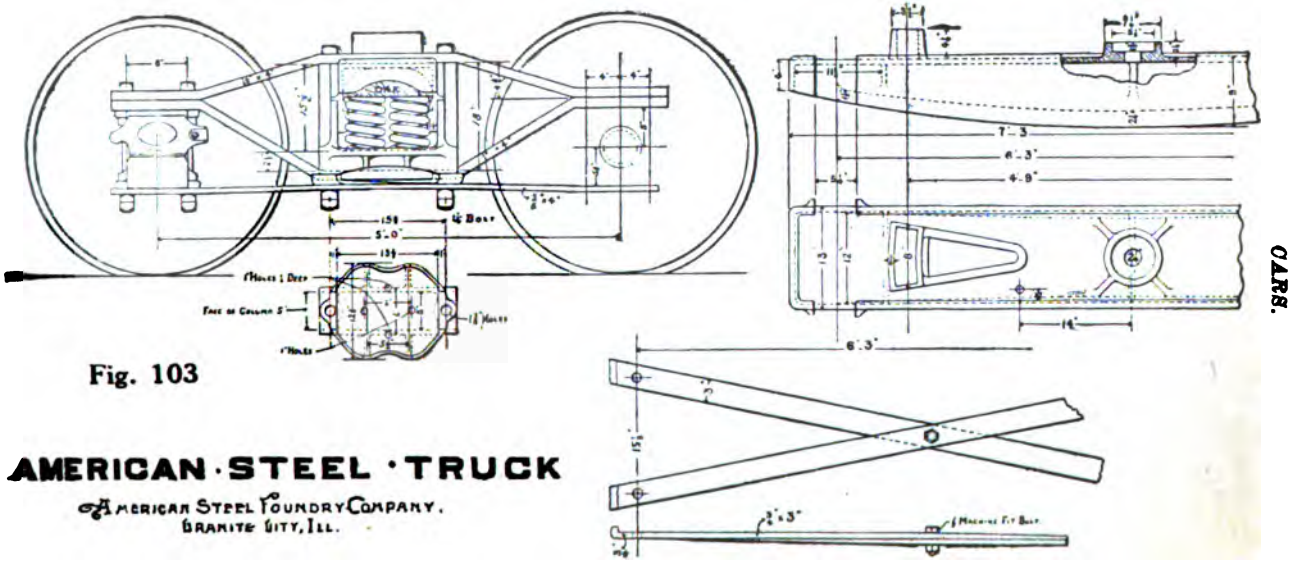


Fig. 103

AMERICAN · STEEL · TRUCK

American Steel Foundry Company.
Granite City, Ill.

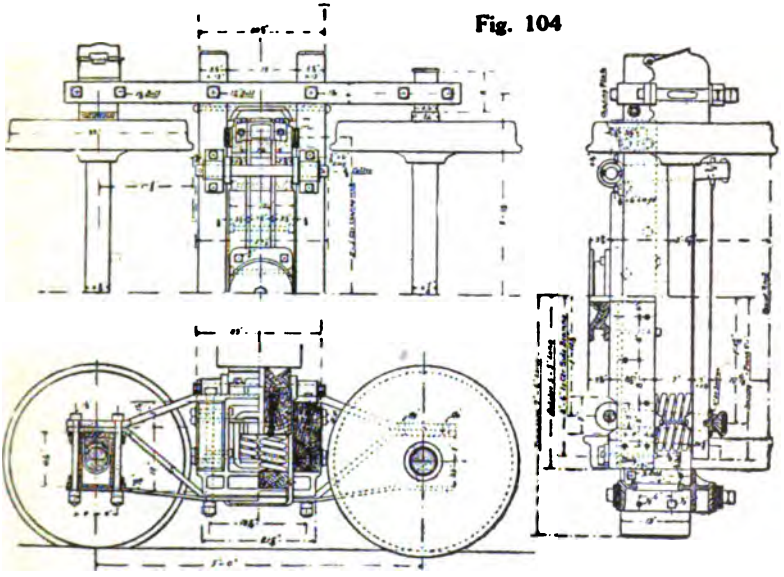
Following are practical specifications for Freight Trucks.

SPECIFICATIONS FOR HIGH FREIGHT TRUCK FOR CARS OF 60,000 LBS. CAPACITY.

The drawing, Plate III., shows the general plan.

The following supplementary specifications for material will form a part of these specifications:

Fig. 104



30-TON SWING MOTION TRUCK.

1. Specifications for Car Axles.
2. Specifications for Wrought Iron.
3. Specifications for Steel Channels.
4. Specifications for Mild Steel.
5. Specifications for Cast Iron Wheels.
6. Specifications for Helical Springs.

The following materials will be furnished, free of charge at the works of the builder, by the railway company.

1. Bolster springs.
2. Journal bearings.
3. Paint stocks of all kinds ready for use.

General Instructions.—The trucks are 60,000 lbs. capacity, of rigid design, and have railway company's standard M. C. B. oil boxes, brass, wedge, axle and brake head and shoes, known as the Congdon pattern. The drawings have all necessary dimensions and instructions relative to design, sizes, weights, etc. Rivet holes must be punched 1/16 inch larger than the rivets. All rivets must be put in with either the pneumatic or hydraulic riveting machines.

Axles.—Axles are railway company's standard M. C. B., of 60,000 lbs. capacity. The date the axle is placed under the car must be plainly stamped with ½ inch figures on one end. The wheel seat must be finished straight, no "taper" will be allowed. The fitting cut must be made smooth with a broad faced tool to prevent thread forming on the wheel seat. Journals must be finished with smooth cut, if necessary smoothed with emery to insure a proper surface.

Wheels.—Wheels must conform in construction and fill all requirements and guarantee of railway company's specifications for car wheels. The wheel seat must be bored parallel, and must be pressed on the axle at a pressure of not less than twenty-five (25) nor more than thirty (30) tons. The gauge of the wheels is 4 feet, 7⅞ inches, and must be determined by the use of a gauge that will be furnished by the railway company. On the inside plate of wheel must be cast a diagram of raised figures; those indicating the year and month the wheel was placed under the car must be chipped off.

Journal Boxes.—Are standard M. C. B. box of cast iron, and must be thoroughly cleaned by rattler or otherwise, to avoid sand on inside when ready to be applied. They must be packed with one and one quarter (1¼) pounds of the best cotton waste, and enough (one gallon at least) lubricating oil of good quality to insure cool running of same. The spring on lid must be sufficiently strong to hold lid firmly against the box.

Journal Box Wedges.—Journal box wedges are of cast steel or hydraulic forged iron and must conform to sizes and shape of M. C. B. standard box for cars of 60,000 lbs. capacity.

Journal Bearings.—Are M. C. B. standard, and will be furnished by the railway company.

Dust Guards.—Are made of basswood, and are 11/16 inch thick. They must fit tightly on the axle dust guard. A piece of zinc, 1 inch wide, must be inserted in the ends and securely clinch nailed to prevent splitting. After the trucks are put together a small block of wood must be driven tightly into the dust guard opening.

Arch Bars.—The top arch bar is 1⅛ inches by 4½ inches; the lower bar is 1 inch by 4½ inches. The tie straps are of wrought iron ½ inch by 4 inches. The arch bars must be bent hot. The tie straps may be bent cold. The holes in the arch bars must be drilled. The holes in the tie straps may be punched.

Arch Bar Bolts.—Those used in the truck end are 1⅜ inches in diameter; under the head must be a fillet of at least 1-8 inch radius. The bolt holes in the top side of the top arch bar must be countersunk in such a manner, either by punch or drill, to receive this fillet when the head is pulled down tight to the bar. Oil box bolts are 1⅛ inches in diameter, with a small fillet under the heads.

Bolsters.—Are two channels 7 inches wide and 7 feet 3 inches long, of 13.6 lbs. per ft. with top plate 7/16 inch by 11½ inches by 7 feet 3 inches, plate riveted on top of channels, tieing them together with ¾ inch rivets; between these channels and secured at the ends with ¾ inch rivets is a 7-inch tension channel of 13.6 lbs. per ft., bent as shown on detail drawing and separated at center of bolster by a malleable iron strut casting The lower channel, or spring plank, is a 13-inch channel 31.5 lbs. per ft., the ends rest on the lower arch bars and are secured to truck pillars with ¾ inch bolts.

Malleable Castings.—Spring seats. Lower spring seats. Truck pillar. Truck side bearing. Dead lever. Brake hanger. Truck bolster guides. Truck bolster strut. Brake head. Brake beam fulcrum.

Bolster Springs.—Will be furnished by the Railway Company, and are class J of specifications for helical springs.

Brake Heads and Shoes.—Are M. C. B. standard. The shoes are 15½ inches long and have seven pieces of wrought iron, 1 inch by ¾ inch by 2-¾ inches long, let into their face after the Congdon pattern of shoe.

Bolts and Nuts.—All bolts and nuts must have U. S. standard threads and cut to work with Railway Company's stubs, which will be furnished.

Castings.—If desired, a set of sample castings will be furnished by the Railway Company. All castings must be equal in weight, size, dimensions and quality to those furnished. Pattern numbers and initials of Railway Company must be cast on each piece. All malleable iron castings must have the shop or trade marks of maker cast upon them for future identification of castings.

Painting.—All iron work shall receive one coat of black asphaltum paint. All paints used will be furnished free at the works of the builder by the Railway Company, on requisition of the Builder.

Lettering.—On one bolster of each truck must be stenciled

the initials of the Railway Company, and the number of the car, as shown on drawings.

General Instructions.—All material which enters into the construction of trucks built under these specifications must conform to them fully in weight, size and quality. All work must be done in a thorough and workmanlike manner; and the material and workmanship is subject to inspection by a representative of the Railway Company at all times. Companies or individuals furnishing material for these trucks, or those who are building them, must furnish every facility to expedite the inspection of materials and workmanship. It is the intention that these written specifications, and the drawings that form a part thereof, shall harmonize in every particular. Any change from the specifications or the drawings, or any discrepancies which may be found, should be at once reported in writing to the railway company for decision. All specifications and drawings for high freight truck for cars of 60,000 lbs. capacity, which have been issued by the Railway Company prior to this date, are null and void. To prevent mistake, they should be returned to the Railway Company.

The bolsters used in these trucks are covered by letters patent.

SPECIFICATIONS FOR LOW FREIGHT TRUCK FOR CARS OF 80,000 LBS. CAPACITY.

The drawing, Plate IV. shows the general plan.

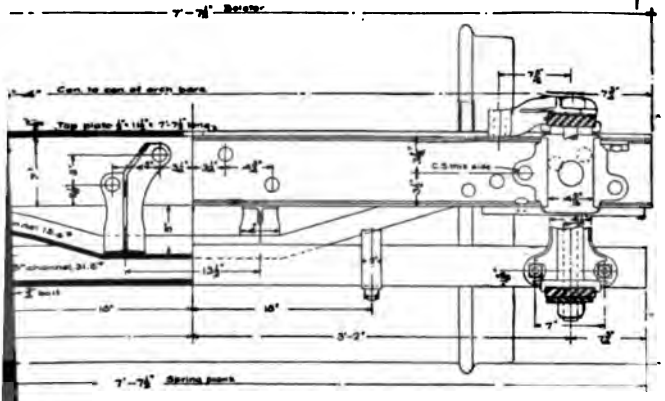
The following supplementary specifications for material will form a part of these specifications:

1. Specifications for Car Axles.
2. Specifications for Wrought Iron.
3. Specifications for Steel Channels.
4. Specifications for Mild Steel.
5. Specifications for Cast Iron Wheels.
6. Specifications for Helical Springs.

The following materials will be furnished, free of charge at the works of the Builder, by the Railway Company.

1. Bolster springs.
2. Journal bearings.
3. Paint stocks of all kinds ready for use.

General Instructions.—The trucks are 80,000 lbs. capacity, of rigid design, and have Railway Company's standard M. C. B. oil boxes, brass, wedge, axle and brake head and shoes, known as the Congdon patterns. Rivet holes must be punched 1/16 inch larger than the rivets. All rivets must be put in with either the pneumatic or hydraulic riveting machines.



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The drawings give all necessary dimensions and instructions relative to design, sizes, weights, etc.

Axles.—Axles are Railway Company's standard M. C. B., of 80,000 lbs. capacity. The date the axle is put under the car must be plainly stamped with ½ inch figures on one end. The wheel seat must be finished straight,—no "taper," will be allowed. The fitting cut must be made smooth with a broad faced tool to prevent thread forming on the wheel seat. Journals must be finished with smooth cut, if necessary smoothed with emery to insure a proper surface.

Wheels.—Wheels must conform in construction and fill all requirements and guarantee of Railway Company's specifications for car wheels. The wheel seat must be bored parallel, and must be pressed on axle at a pressure of not less than twenty-five (25) nor more than thirty (30) tons. The gauge of the wheels is 4 feet 7⅞ inches, and must be determined by a gauge that will be furnished by the Railway Company. On the inside plate of wheel must be cast a diagram of raised figures; those indicating the year and month the wheel was placed under the car must be chipped off.

Journal Boxes.—Are standard M. C. B. box of cast iron, and must be thoroughly cleaned by rattler or otherwise, to avoid sand on inside when ready to be applied. They must be packed with one and one-quarter (1¼) pounds of the best cotton waste, and enough (one gallon at least) lubricating oil of good quality to insure cool running of same. The spring on lid must be sufficiently strong to hold lid firmly against the box.

Journal Box Wedges.—Journal box wedges are of cast steel or hydraulic forged iron and must conform to sizes and shapes of M. C. B. standard box for cars of 80,000 lbs. capacity.

Journal Bearings.—Are M. C. B. standard, and will be furnished by the Railway Company.

Dust Guards.—Are made of basswood, and are 11/16 inch thick. They must fit tightly on the axle dust guard. A piece of zinc, 1 inch wide, must be inserted in the ends and securely clinch nailed to prevent splitting. After the trucks are put together a small block of wood must be driven tightly into the dust guard opening.

Arch Bars.—The top arch bar is 1⅛ inches by 5 inches; the lower bar is 1 inch by 5 inches. The tie straps are of wrought iron ½ inch by 4½ inches. The arch bars must be bent hot. The tie straps may be bent cold. The holes in the arch bars must be drilled. The holes in the tie straps may be punched.

Arch Bar Bolts.—Those used in the truck end are 1½ inches in diameter; under the head must be a fillet of at least ⅛ inch radius. The bolt holes in the top side of the top arch bar must be countersunk in such a manner, either by punch

or drill, to receive this fillet when the head is pulled down tight to the bar. Oil box bolts are 1⅛ inches in diameter, with a small fillet under the head.

Bolsters.—Are two channels 7 inches high and 7 feet 7½ inches long, of 13.6 lbs. per ft. with ½ inch by 11½ inches by 7 feet 7½ inches plate riveted on top of channels, tieing them together with ¾-inch rivets between these channels and secured at the ends with ¾-inch rivets is a 7-inch tension channel of 13.6 lbs. per ft., bent as shown on detail drawing and separated at center of bolster by a malleable iron strut casting. The lower channel, or spring plank, is a 13-inch channel 31.5 lbs. per ft., the ends rest on the lower arch bars and are secured to truck pillars by ¾-inch bolts, with double nuts.

Malleable Castings.—Spring seats. Lower spring seats. Truck pillar. Truck side bearing. Dead lever connections. Brake hanger. Truck bolster guides. Truck bolster strut. Brake head. Brake beam fulcrum. Truck center plate.

Bolster Springs.—Will be furnished by the Railway Company, and are class "J" of specifications for helical springs.

Brake Heads and Shoes:—Are M. C. B. standard. The shoes are 15½ inches long and have seven pieces of wrought iron. 1 inch by ¾ inch by 2¾ inches long, let into their face after the Congdon pattern of shoe.

Bolts and Nuts.—All bolts and nuts have U. S. standard threads and cut to work with the Railway Company's stubs which will be furnished.

Castings.—If desired, a set of sample castings will be furnished by the Railway Company. All castings must be equal in weight, dimensions and quality to those furnished. Pattern numbers and the initials of the Railway Company must be cast on each piece. All malleable iron castings must have the shop or trade marks of maker cast upon them, for future identification of castings.

Painting.—All iron work shall receive one coat of black asphaltum paint. All paints used will be furnished free at the works of the builder by the Railway Company, on requisition of builder.

Lettering.—On one bolster of each truck must be stenciled the initials of the Railway Company and the number of the car, as shown on drawings.

General Instructions.—All material which enters into the construction of trucks built under these specifications must conform to them fully in weight, size and quality. All work must be done in a thorough and workmanlike manner; and the material and workmanship is subject to inspection by a representative of the Railway Company, at all times. Companies or individuals furnishing material for these trucks, or

those who are building them, must furnish every facility to expedite the inspection of material and workmanship. It is the intention that these written specifications and the drawings that form a part thereof, shall harmonize in every particular. Any change from the specifications or the drawings, or any discrepancies which may be found, should be reported at once, in writing, to the Railway Company for decision. All specifications and drawings for low freight truck for cars of 80,000 lbs. capacity, which have been issued by the Railway Company prior to this date, are null and void. To prevent mistakes, they should be returned to the Railway Company. The Bolsters used in these trucks are covered by letters patent.

CHAPTER VI.

PRACTICAL SPECIFICATIONS FOR TYPICAL FREIGHT CAR BODIES:—BOX, FLAT, GONDOLA, STOCK, ORE.

The Box Car.—By far the most common form of American freight car it is as its name implies inclosed with roof and sides—a box in fact upon two trucks.

SPECIFICATIONS FOR BOX CAR 80,000 LBS. CAPACITY.

The drawings referred to in these specifications, and forming a part of the same, are as follows:

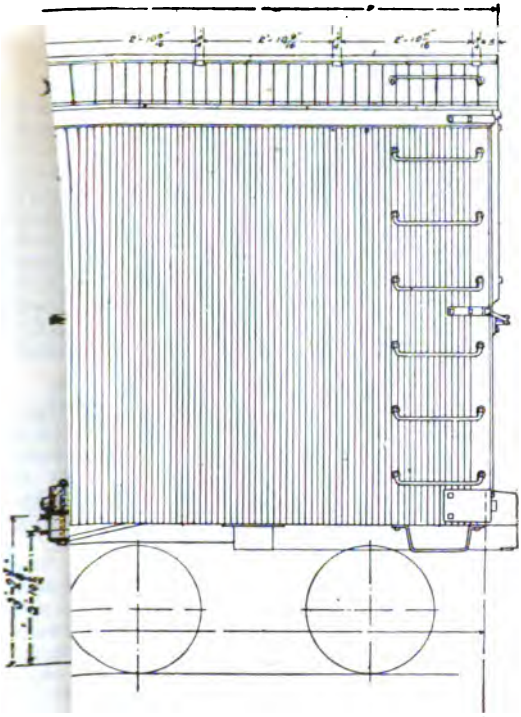
Elevation and plan.
End view and doors.
Wood details.
Wrought details.
Cast details.
Draft rigging and details.
Location of air brakes.
Air brake details.
Lettering.
Grain door.
Grain door details.

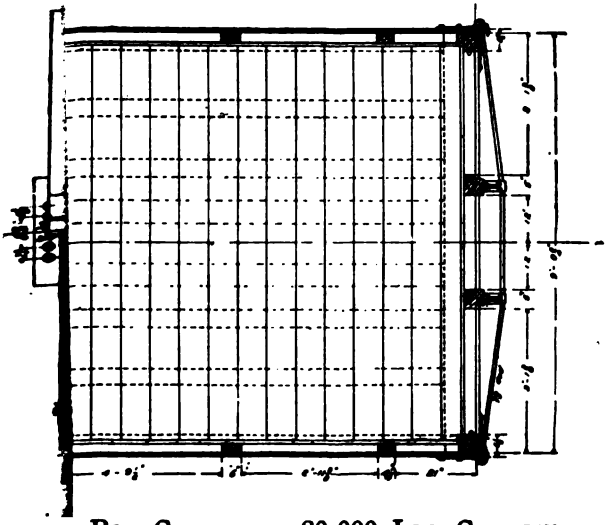
The following supplementary specifications for material will form a part of these specifications:

1. Specifications for the purchase of Wrought Iron.
2. Specifications for the purchase of Mild Steel.
3. Specifications for the purchase of Helical Springs.

The following materials will be furnished, free of charge at the works of the builder, by the Railway Company.

1. Draw bar springs.
2. Automatic couplers.
3. Air brakes.
4. Plastic roofing paper.
5. Paint stocks of all kinds ready for use.





Box Car. **80,000 Lbs. Capacity.**

GENERAL DIMENSIONS.

Length over end sills	36′ 8¼″
Length inside	36′ 0½″
Width over side sills	9′ 0¾″
Width inside	8′ 6″
Width over eaves	9′ 7″
Height inside, floor to car line	8′ 0″
Height of girth from floor	3′ 10½″
Height of wheat and corn line	5′ 6″
Height of coal line	5′ 0″
Height of lining	5′ 4¼″
Height of draft line	2′ 10½″
Cubical capacity	2,450

Framing.—The side, intermediate and center sill, side plates and ridge pole are of Southern pine; the carlines end plates, side posts, braces and belt rails may be of Southern pine, free of sap and knots, or of white oak of such quality as is suitable for the purpose intended. The end sills, cross center ties, deadwood blocks, corner and door posts must be made of white oak of suitable quality.

The longitudinal sills must be sound and clear; one corner may be sappy, but not to exceed 1½ inches in width or thickness. In framing sills with sap, the sap edge must always go downward. The longitudinal sills are framed into the mortises of the end sill with double tenons, 1¾ inches in length by 1½ inches in thickness, the full width of the thickness of the sill, except the outside sill, which is to have a relish on the outside face, as indicated by the detailed drawings. The longitudinal sills rest on top of the body bolster plate. The braces of the car must be of such length as to fit tightly between the post, sill and plate when the car is jacked up in the center and on the ends, to the proper camber.

Buffer Blocks.—The two oak buffer blocks are 5½ inches by 8 inches thick, and 2 feet 6 inches in length, beveled on the top face and gained on the lower front edge to receive the wrought buffing angles. The details are shown on the drawings. They are bolted to the end sill with two center truss rods and two ⅞-inch bolts. The back face and the front face of the siding and end door posts, where they come in contact, must have a heavy coat of wood preservative paint before they are secured in position.

Cross Center Ties.—Or needle beams, are 4½ inches in thickness, 8½ inches in width and 9 feet ¾ inch in length. They are bored in such a manner as to secure them to the side, intermediate and center sills. The truss rod queen posts are secured to them by means of lag screws and bolts fastened through sills.

Side Plates.—Are of Southern pine, 3¼ inches by 6 inches by 36 feet, 8¼ inches long, mortised and bored to receive the side and door posts and side rods. There are to be filling blocks 2 inches by 3¼ inches on top of each side plate, properly fitted between the carlines, each block to be secured to plate with six 20-penny spikes, blocks to be bored, with proper size holes to prevent them from splitting. The end plates may be of white oak or Southern pine, free of sap, or knots, 3 inches by 15 inches, and are to be secured to the side plates by means of tenons 1¼ inches deep, and ½ inch strap bolts, one at each corner, which pass through the outside corner bands, as shown on the drawings.

Carlines.—There are eleven carlines of white oak or Southern pine, free of sap or knots, 1¾ inches in thickness. Each end of the carline is secured to the side plate with two No. 20 screws, 3½ inches long, and one No. 20 screw 4 inches long, turned into the plates after first boring holes the proper size for them. Under no circumstances will the driving of screws in any part of the construction be permitted.

Ridge Pole.—Is of Southern pine, in one length, 1¾ inches in thickness by 4 inches; shaped on the top edge to the proper pitch of the roof; it must be securely nailed to each carline and each plate with two 3½ inch spikes. It is also bolted to end plates with ⅝-inch strap bolts as shown.

Purlines.—Are of white oak, straight in the grain and free of knots, and may be made in three lengths; the joints must be staggered, or if made of Southern pine, they must be in one length, free of sap and knots, 1¾ inches in thickness by 2½ inches in width. They are to be securely nailed to each carline and end plate with two 3½-inch spikes.

Braces.—Body or counter braces may be of either white oak or Southern pine, 2½ inches by 5 inches. The end braces may be of the same material, 3 inches in thickness by 5 inches in width, framed to such length and shape as to fit tightly in the openings when the car is properly cambered.

Corner Posts.—Are of white oak or Southern pine, free of sap and knots, 5½ inches by 5½ inches, 9 feet ¾ inches long. The end sills are cut out at the ends to receive the lower ends of the posts, as shown on drawings.

Body Posts.—Are of white oak or Southern pine, free of sap and knots, 2½ inches in thickness by 5 inches wide. The ladder posts are to be 2½ inches by 4¼ inches. The posts over the body bolsters are to rest in cast iron pockets, and are ½ inch shorter from the end to shoulder than are the side posts.

Door Posts.—The side door posts are of white oak, 4½ inches by 4 7/16 inches, framed so that they lap over side sills, and each post is secured to side sill by means of two ⅝-inch bolts.

The distance between the side door posts is 5 feet. The end door posts are white oak, 5 inches by 5 inches. The distance between them is 2 feet. A cleat 3 inches by 1 inch and 3 feet 6¾ inches long, is nailed to each door post, to which is secured the sheathing.

Flooring.—Except at the doorway is either Southern or Norway pine, 1¾ inches in thickness, shiplapped on the edges to match the Railway Company's standard. It must not be less than 4 inches nor more than 8 inches in width, and in laying, wide and narrow strips must alternate. It must be surfaced on one side, and nailed to the sills with 30-penny nails. Pieces from 4 to 6 inches in width shall be nailed at each sill with two 30-penny nails, staggered; pieces from 6 to 8 inches wide shall be nailed at each sill with three 30-penny nails, one of which may be driven blind.

Sheathing.—The sheathing is of dry white pine, first class siding in quality; or Oregon fir, in the latter, heart cuts, which are liable to split or shell out, must be omitted, matched and grooved to the Railway Company's standard, with small V-shaped grooves on its face, 1¾ inches from center to center. It is to be dressed on two sides to 27/32 of an inch in thickness and 5¼ inches in width; it must be nailed to each plate with three 8-penny nails, one of which is to be driven blind, to each belt rail with three 8-penny nails, one driven blind, to each sill with five 8-penny nails, one driven blind, and to the braces with two 8-penny nails to each piece.

Lining.—May be of dry white pine, "B" or "second common" in quality, Southern or Norway pine, matched and grooved, ⅞ inch in thickness and 5¼ inches in width. The lining is raised 2¾ inches from the floor, and nailed to the posts and braces with three 8-penny nails at each post and brace, one nail at each brace to be driven blind. Nailed to the floor, with one face bearing against the sheathing and the other on the floor, is a triangular piece of pine, 2¾ inches by 2¾ inches.

The lining at sides of car will extend three boards higher than girth, as shown on drawings.

Roofing.—Is dry white pine, free from sap, dead knots and shaky places. The under course is of "B" "first common" grade, $^{27}/_{32}$ of an inch thick by 5¼ inches wide, surfaced on both sides, matched and grooved; each piece is nailed to the fascia board, plate, purlines and ridge pole with not less than three 8-penny cut nails at each place, one nail may be driven blind. One heavy coat of No. 1 mineral paint is then to be applied to the top of roof, over which will be placed a layer of plastic roofing paper which will be furnished by the Railway Company. The top course of boards is first-class siding, $^{27}/_{32}$ of an inch thick by 5¼ inches wide, matched and

grooved with two half-round grooves worked in top face. It is to be nailed with three 10-penny cut nails in the same manner as the lower roof and must be cut off to project 1⅜ inches over the fascia boards on the side. The plastic roofing must be laid in such a manner as to have it cut off with the boards. Care must be taken in securing the roof, not to drive any of the nails so that they will miss plates, carlines or ridge poles. The quality of lumber as indicated in these specifications will be found in Judson's Revised Edition of the Lumbermen's Hand Book of 1891, "Chicago Yard Grading of Pine."

Long leaf Southern pine must be used in all instances where Southern pine is mentioned.

Fascia Boards.—The side fascia boards are white oak, of suitable shape, 1¾ inches thick, by 5 inches wide, and are bolted to the plates with ½-inch bolts. The end fascia boards are Norway pine, 1¾ inches thick by 15 inches at their widest place. They are secured to the end plates by means of ½-inch bolts and corner plates, as shown on drawings. Two nails must be used in each piece of roofing for securing the edge of the roof to the fascia boards, care being taken to have these nails driven into the fascia boards and not to the outside or into the fascia joints.

Running Boards.—Are clear Norway pine, free from knots, sap and shaky places. The middle board is 2¼ inches thick by 6 inches wide, shaped to fit over the ridge of the roof, and notched to receive the running board cleats, and secured to the roof with two 3-inch No. 18 screws at each cleat, and two No. 18 screws midway between the cleats. The two side pieces are 1¼ inches thick by 6 inches wide and secured to each cleat by two 8-penny nails. The cleats are of white oak, 1¾ inches thick, shaped to fit the pitch of the roof. They are secured over each carline and end plate, and nailed to the roof with four 30-penny nails to each cleat. The cleats must be bored for the nails. Before the running boards and cleats are applied, the roof must be given a heavy coat of the Railway Company's standard No. 1 paint underneath the cleats and running boards.

Girths.—The side girths are of white oak, 3¾ inches by 4 inches, the end girths 4¼ inches by 4 inches, all shaped as shown on drawings. They are secured to posts and braces with two No. 18 screws, 2½ inches in length and one 8-penny nail, and to each corner and door post with ½-inch strap bolts; these strap bolts must pass through the corner plates. The end girths are secured to the end door posts with four ⅝-inch carriage bolts, 6½ inches long, and four No. 13 screws, 2½ inches long. The distance from the top of the sill to the top of the girth is 4 feet ¼ inch.

Side Doors.—Are what are known as batten doors, the sheathing of which is the same as that used on the side of the car. There are three 9½-inch battens on the back side with four filling pieces 7½ inches wide, to fill up the spaces on the edges of the door between the battens. They are to be well nailed with four clinch nails to each batten and properly clinched on the back side. On the two side edges are protecting strips, 1¾ inches by ¼ inch, secured alternately to the inside and outside with 1½ inch No. 18 screws spaced 10⅝ inches. They are to receive one heavy coat of the Railway Company's standard No. 1 paint on the back side of the door. The hangers are to be Railway Company's standard malleable iron, applied as shown on drawings. The handle is to be secured by six 1½-inch No. 14 screws, located as shown.

End Doors.—Are batten doors; the outside of sheathing is the same as used on the side of the car, except the side rails, which are oak, 5½ inches wide, the inside sheathing is run crosswise and 5¼ inches wide, 3 feet 10⅞ inches high by 2 feet 3 inches wide. Weather strip is to be placed on the edge of these doors of ⅛ inch by 1½ inch iron, the full length of the door, secured to the edge with 1½-inch No. 12 screws, located 7 inches apart, and a strip of rubber between the edge of the door and the iron strip to project sufficiently far to touch the side of the car.

End Door Tracks.—Are of wrought iron; the upper track is ¼ inch by 2½ inches wide and 4 feet 2½ inches long; they are bolted to the end plates with three ½-inch bolts passing through the track, brackets and plate. The lower track is ⅜ inch by 2 inches and 4 feet ½ inch long, bolted to the end girth with four ½-inch bolts passing through the track, brackets and end girth, as shown on drawings.

Side Door Tracks.—The top side door track is ¼ inch thick by 2½ inches wide and 10 feet 6 inches in length; it is secured to the side of the car by eight ½-inch bolts passing through the guides, filling piece and side plates. The bottom track is ⅜ inch thick by 2 inches in width and 10 feet 6 inches in length, secured to the side of the car by eight ½-inch bolts passing through the track, brackets, sheathing and sill of car.

Door Stops.—The closed door stop for the side door is of white oak, 2⅛ inches thick by 4 inches wide and 8 feet 3¼ inches long. It is secured to the door post and belt rail by six ½-inch bolts, with the nuts sunk flush on the inside of the car. The closed door stop for the end door is of white oak, 2 inches by 2¼ inches, 4 feet 4¾ inches long; it is secured to the end post with three ½-inch lag screws, 4½ inches long. The details of the framing of these stops are shown on draw-

ing. The open door stop is of cast iron, and located as shown on the drawings.

Door Fastenings.—The end and side doors are locked with Railway Company's standard car door fastenings, as shown on the drawings.

Door Thresholds.—The end door threshold is of white oak, 3 inches by 6¼ inches and 2 feet 10 inches long; it is bolted to the end girths with two ½-inch bolts and the door posts with four 10-penny nails. On the threshold is a piece of wrought iron 3/16 inch thick by 4 inches in width and 24 inches long, secured to the same by eight No. 14 screws, 1½ inches long. The side door threshold is 3/16 inch thick by 4 inches in width and 5 feet in length, secured to the floor of the car by eleven No. 14 screws, 1½ inches in length.

Water Strips.—There is nailed to the end fascia board over each end door a piece of white oak, shaped as shown in the drawing, to serve as a water shed.

Grain Doors.—There are two grain doors of the Railway Company's standard, applied as shown on the drawing. The doors are 3 feet 6 inches high and have a flap 15½ inches wide hinged to bottom door. The details are shown on drawing.

Side Plate Tie Rods.—There are five ⅝-inch round iron plate tie rods, extending to the outside of the side plates immediately beneath the carlines, to prevent the side plates from spreading. They are secured to the carlines at the middle by 3/16 inch staples, 2½ inches long, driven into the bottom edge of the car line.

Plate and Sill Rods.—There are twenty-four ⅝-inch tie rods extending through sill and plates, eight of these have ⅝ inch round ends welded to ¼ inch by 2 inch bar iron as shown in detail. The rods for the body post are grooved into them, the four corner rods are straight, the rods for door posts have straps on upper ends which are bolted to the plates, and the tie rods pass through their girths next the sheathing, forming a truss rod for side and end door posts.

Body Side Bearings.—There are two 10 inches by ½ inch pressed steel bearings to each bolster, each side bearing will be riveted to the bolster, with four ¾-inch rivets. The distance from center of side bearings will be 5 feet.

Body Bolsters.—Is the Z bar type, riveted together with ¾-inch rivets, and built up as shown on drawings.

King Bolts.—There are two king bolts, 1¾ inches in diameter by 17 inches long. They are provided in the center with a ring, ¾ inch in thickness by ¾ inch in width, as indicated on the drawings.

Truss Rods.—There are six truss rods, 1¼ inches in diameter, increased to 1½ inches in diameter, 5 inches in length

at each end They are in two lengths, connected in the middle with wrought iron turnbuckles of a satisfactory make, each turnbuckle is connected with the adjacent one with a strip of wood of suitable dimensions through the openings in the turnbuckles to prevent them from turning. The wooden strip is secured so that it cannot get out of place. The truss rod washers which bear against the end sill of the car, are of gray iron, 5 inches by 5 inches, as shown on the detail drawings. The truss rod queen posts are shown on the drawings, and must be of malleable iron and secured to the needle beam by lag screws and bolts. The posts are provided with a split key or other means to prevent the truss rod from falling in case of breakage.

Draw Bars and Springs.—The draw bars are M. C. B. standard and are furnished by the Railway Company. The pockets for the same are ⅞ inch by 4 inches iron, and riveted to the drawbars with two 1⅛-inch ulster iron rivets, leaving the ends of the pocket to be formed as shown on the drawings and be driven into the recess of the draw bar while the ends of the pocket are hot. After they have been properly drawn together and riveted, the lugs on the ends must be drawn down under the hammer until they fill the space between the lugs of the draw bars.

Draw Bar Springs.—Are the Railway Company's standard, and will be furnished by the Railway Company.

Draft Sills.—Are of white oak, 5½ inches by 7 inches thick and 5 feet 1⅞ inches long; they are gained out on the top edge to receive the cast iron draft timber keys, on the side to receive the draw bar stop castings. On the outside of each draft sill there is a ⅞-inch strap bolt securing same to body bolster. Bolted to the center sills are the reinforcing pieces 6 inches by 5 inches which form the continuous draft timbers to resist buffing strains. There are ten ¾-inch bolts, and twelve ¾-inch lag screws, 8 inches long, securing these timbers to the center sills, all as shown on drawings.

Corner Plates.—At each outside lower corner of the car is a corner plate, ¼ inch thick by 8½ inches in width, to extend 12 inches on the side of the car and 10 inches on the end of the car. They are bolted to the end and side sills with ⅝-inch bolts. The middle plates are ⅜ inch thick, 2½ inches wide and 11 inches long on each leg bent in the center to form a seat for end truss rod. They are secured to the sheathing with ½-inch strap bolts and ½-inch lag screws 3½ inches long. The upper corner plates are ½ inch in thickness by 2 inches in width, and 11½ inches on each leg. They are secured to the plates by bolts and lag screws as shown on drawings.

Sill Steps.—There are two sill steps of wrought iron, ⅝

inch by 2 inches, shaped as shown on the drawing; each step is secured to the under edge of side sill with one ⅝-inch lag screw 4½ inches long, and by the corner post rod.

Ladder.—There is a ladder on the side of the two diagonal corners of the car, made up of six handles to a side and one on the roof, of ⅝-inch round iron 22 inches in length, and fastened with ½-inch lag screws, 3 inches long. There are two on each end of the car 24 inches long. There are two on each end of the car 24 inches from the bottom of the sill, as shown on the drawings. These are to act as handholds and are secured with ½-inch lag screws, 3 inches in length.

Brake Shaft.—Is of 1¼-inch round iron with bottom ends 1½ inches in diameter; it rests in a wrought iron step secured to the end sill with two ⅝-inch bolts. The brake wheel is 17 inches in diameter and held on the shaft with ¾-inch nut; the end of the shaft is riveted over the nut. The upper brake shaft bracket is malleable iron and is secured to the plate with two ½-inch bolts, with nuts placed outside of the car, and to the roof with ⅝-inch lag screws, 5 inches long. The location of the brake is shown on the drawing.

Foundation Brake.—All wheels are provided with brakes. The arrangement of the foundation brake is shown on drawings. The details of rods, levers, guides, clamps, etc., are shown on the detail drawings.

Air Brake.—The air brake is the Westinghouse automatic, quick acting freight brake and located as shown on the foundation brake drawings. All joints in the piping and fittings must be put together with red lead, and in no case will work be accepted unless the pipe screw going into the fitting will take four or more threads. They must be thoroughly tightened and well secured to the frame of the car. Test of same must be made with 70 lbs. air pressure. All cars must be charged and applications made on same before leaving the shops.

The following air brake equipment will be furnished by the Railway Company; brake cylinder, reservoir, triple valve, drain cup, couplings with hose complete, angle cock, cut-out cock and release valve, as per Westinghouse Company's schedule, H-1.

Wrought Iron or Soft Steel.—Wrought iron or soft steel used in the construction of the following parts will be subject to surface inspection only and the requirements of the physical tests will be waived. Corner irons of all kinds, top and bottom, side and end door tracks, side and end door protecting strips, threshold plates and grain door plates.

Castings.—If desired, a set of sample castings will be furnished by the Railway Company, and all castings used on the cars must be equal in weight and correspond in dimensions

with the samples furnished. The initials of the Railway Company, together with the pattern numbers must be plainly cast on every piece. All malleable iron castings must have the shop or trade marks of the maker cast upon them for future identification of castings.

Grain and Coal Line.—Is painted on the inside near the doorway; the wheat and corn line is 5 feet 6 inches from the top of floor, and the coal line is 5 feet from top of floor.

Mortises and Tenons.—All mortises and tenons, tenon shoulders, butting joints of braces and post, sills, etc., the top and outside face of the side and end sills, the top and outside face of the side and end plates, are to receive one heavy coat of the Railway Company's wood preserving creosote paint.

Painting.—The car is to be painted on the outside with three coats of the Railway Company's standard No. 1 mineral paint; the iron work where exposed is to receive one coat of asphaltum black paint. The edges of the top and bottom course of roof boards are to receive one coat of No. 1 mineral paint before being laid. The first course of the roof is to receive one coat of No. 1 paint before the plastic paper is applied. The exterior of the car must not be painted oftener than once in twenty-four hours. The body of the trade mark is the Railway Company's standard No. 26 paint. The lettering for the cars is the Railway Company's standard No. 17 paint. The location and arrangement of lettering is shown on drawing. Pounce patterns for all lettering, trade marks, etc., will be furnished by the Railway Company.

Bolts and Nuts.—All bolts and nuts are to have U. S. standard threads, and to correspond with the samples which will be furnished by the Railway Company.

Trucks.—Drawings and specifications for the Railway Company's high freight truck, for cars of 80,000 pounds capacity, accompany and form a part of these specifications.

General Instructions.—All material which enters into the construction of cars built under these specifications must conform to them fully in weight, size and quality. All work must be done in a thorough and workmanlike manner, and the material and workmanship are subject to inspection by a representative of the Railway Company at all times. Companies or individuals furnishing materials for these cars, or those who are building them, must furnish every facility to expedite the inspection of material and workmanship. It is the intention that these written specifications, and the drawings that form a part thereof shall harmonize in every particular. Any change from the specifications or drawings, or any discrepancies which may be found, should be reported at once in writing to the proper official for decision. All specifications and drawings for box cars which have been issued

by the Railway Company prior to this date, are null and void. To prevent mistakes, they should be returned to the company.

The Flat Car.—A platform upon wheels constitutes the flat car and it is used in the regular freight service for transporting such coarser kinds of freight as need no protection from the elements and is of such character that it is not liable to depredations.

SPECIFICATIONS FOR FLAT CAR, 80,000 POUNDS CAPACITY.

The drawings referred to in these specifications, and forming a part of the same, are as follows:

General Plan.
Wood Details.
Wrought Details.
Cast Details.
Lettering.
Draft Rigging.
Air Brakes.
Air Brake Details.

The following supplementary specifications for material will form a part of these specifications:

(1.) Specifications for the purchase of Wrought Iron.
(2.) Specifications for the purchase of Mild Steel.
(3.) Specifications for the purchase of Helical Springs.

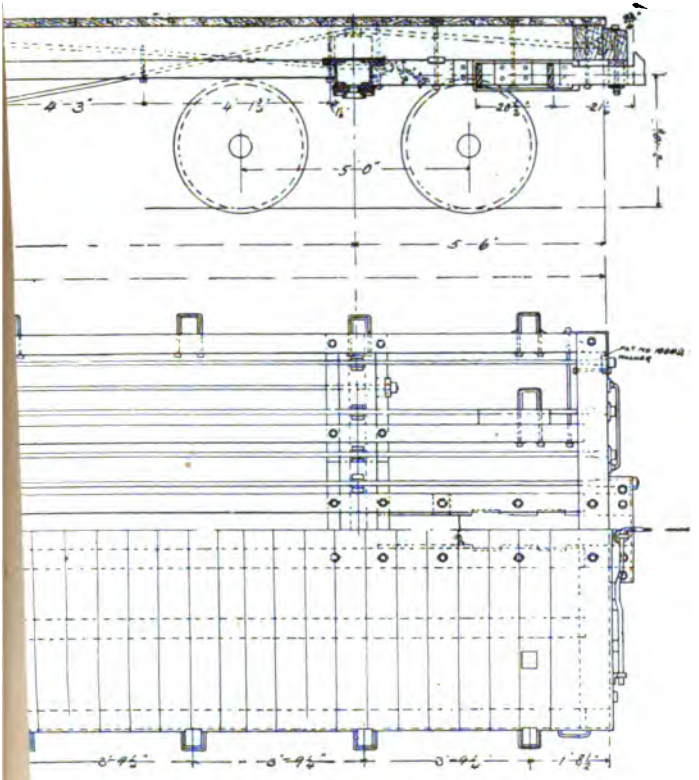
The following materials will be furnished, free of charge at the Works of the builder, by the Railway Company:

(1.) Draw Bar Springs.
(2.) Automatic Couplers.
(3.) Air Brakes.
(4.) Paint stock of all kinds ready for use.

GENERAL DIMENSIONS.

Length over end sills ..... 40′ 0 ″
Width over side sills ..... 8′ 8 ′
Height from top of rail to center of draw bar ..... 2′ 10½″

Framing.—All longitudinal sills are long leaf Southern pine, sound and clear, one corner may be sappy, but not to exceed 1½ inches in width. End sills, cross tie timbers, draft timbers, buffer blocks and air brake cylinder blocks are of oak, of suitable quality for the purpose intended. The bolster fill-



GENERAL PLAN—FLAT CAR.

90,000 LBS. CAPACITY.

ing blocks, and draft timber reinforcing pieces are of white oak or Southern pine of suitable quality, all framed as shown on the detail drawings.

Flooring.—Is Southern or Norway pine, 2¼ inches in thickness, ship-lapped on the edge to match the Railway Company's standard. It must be not less than 4 inches nor more than 8 inches in width. In laying, wide and narrow pieces should alternate. It must be surfaced on one side and nailed to the sills with 40-penny nails, staggered, 4-inch and 6-inch boards to have two nails to each sill and 8-inch boards to have three nails to each sill. The flooring overlaps each side sill ¾ of an inch.

Draft Timbers.—Are of white oak 6 inches by 6⅝ inches thick, and 5 feet 7 inches long. They are gained out on the top face, to receive the cast iron draft timber keys, on the side to receive the drawbar stop castings. Bolted to the center sills, are reinforcing pieces 5 inches by 5 inches, which form the continuous draft timbers, to resist buffing strains. These pieces are secured to center sills by bolts and lag screws.

Filling Blocks.—There are filling blocks 7¾ inches by 6⅝ inches by 1 feet 9⅛ inches long, bolted between drawbar stop castings, body bolster and draft timbers.

Buffer Blocks.—The two oak buffer blocks are 6 inches by 8 inches, and 2 feet 4 inches long, beveled on the top edge, and gained on the lower front face and edge to receive the wrought iron buffing angles. The details are shown on the drawings. The blocks are bolted to the sill with two ¾-inch bolts, and further held by the two middle truss rods. The back face and lower edge, and front face of sills, must have a heavy coat of standard creosote wood preservative paint before the blocks are bolted in position.

Cross Center Ties.—Are 4½ inches by 8½ inches and are 8 feet 8 inches long. They are bored in such a manner as to secure them to the side and center sills, and are gained out on the side sills as shown. The truss rod queen posts are secured to them by means of lag screws, and bolts passing through the sills.

Body Bolster Blocks.—There are ten body bolster blocks of oak, or yellow pine, 6½ inches by 10 inches, of suitable length to fill the space between the sills. They are held in place by cleats nailed to the sills, and the saddles on which the truss rods bear are secured to them. There are also four blocks, 3¾ inches by 6 inches, and 19 inches long, of oak or yellow pine; these are located between the stake pockets and the intermediate sills.

Tie Rods.—There are two ¾-inch tie rods passing across the car from outside to outside of the side sills, located as shown on the drawing.

Stake Pockets.—There are twenty-six malleable iron stake pockets, twenty-two of which are secured to the side sills with ¾-inch "U" bolts, and four are secured to the intermediate sills with ⅞-inch "U" bolts. Their location is shown on the drawings.

Body Bolster.—Is the "Z" bar type, riveted together with ¾-inch rivets, and built up as shown on drawings.

Body Side Bearings.—There are two malleable iron side bearings to each bolster. Each casting is to be riveted to bolsters with ¾-inch rivets, the distance from center to center of side bearings is 5 feet 0 inches.

King Bolts.—There are two king bolts, 1⅞ inches in diameter by 17 inches long, provided in the center with a ring, ¾-inch in thickness by ¾ inch in width, as indicated by the drawings.

Truss Rods.—There are eight longitudinal truss rods; six of which extend from outside to outside of end sills and two of which extend from outside to outside of buffer blocks. They are 1¼ inches in diameter and increased to 1½ inches in diameter for a length of 5 inches at each end. They are in two lengths connected in the middle by wrought iron turnbuckles of a satisfactory make. The turnbuckles are connected in threes with a strip of wood of suitable dimensions passing through their openings to prevent them from turning. The strips are to be secured so that they cannot get out of place. The truss rod washers which bear against the end sills of the car are of gray iron.

Inverted Truss Rods.—There are two longitudinal truss rods extending from outside to outside of body bolster, the ends passing between the two plates of the bolster. They are provided at each end with a washer casting which bears on the edge of each of the bolster plates; these are referred to as inverted truss rods, and they extend above the filling blocks placed on the cross tie timbers. On these blocks are truss rod saddles similar to those that are provided over the body bolsters for the other longitudinal truss rods. Between the cross tie timbers these inverted truss rods pass just beneath the floor of the car.

Corner Plates.—There are four sill plates, ¼ inch by 8½ inches and lap 12 inches on the side and 10 inches on the end of the car. They are bolted to the end sills and side sills with ⅝-inch bolts. The bolts passing through the side sills must also extend through the intermediate sills, as shown on the drawings.

Drawbars and Pockets.—The drawbars are M. C. B. standard and furnished by the Railway Company. The pockets are ⅞ inch by 4 inches iron, and riveted to the drawbar with two 1⅛-inch ulster iron rivets, leaving the ends of the pockets to be

formed as shown on the drawings, and driven into the recesses of the drawbar while the ends of the pockets are hot. They are then drawn together and properly riveted. The lugs on the end must be drawn down under the hammer until they entirely fill the space between the lugs of the drawbars.

Drawbar Springs.—Are the Railway Company's standard and will be furnished by the Railway Company.

Drawbar Stop Castings.—The drawbar stop, or housing castings, are malleable iron, in two pieces, each piece to be bolted to the draft timber with eight ¾-inch bolts, and secured further from longitudinal motion by being let into the draft timber 1 11/16 inches. The drawbar guides are ½ inch by 2 inches, and placed in position as shown on drawing. The carrier iron is 1 inch by 4 inches. The drawbar stop and other castings forming the draft rigging, is known as the Williamson & Pries patent, and the right to manufacture and use the same is owned by the Railway Company. No royalty will be charged to car builders.

Brake Shaft.—The brake shaft is 3 feet 10 inches long and 1¼ inches in diameter. From the lower end, for a length of 2 inches, it is 1 inch in diameter, and for a distance of 17½ inches above this, it is 1½ inches in diameter; this change in diameter is abrupt, and forms a shoulder which rests in a swivelling step provided on the brake shaft bracket. At the top end the shaft is a square for a distance of 2½ inches from the hand wheel. The hand wheel is 17 inches in diameter, and held in place by a ¾-inch nut, the shaft riveted over the nut. This arrangement is so made that by raising the clip, the brake shaft will swing down to a horizontal position, and the brake shaft must be of such length, that the hand wheel will clear the side sill and end flooring when swung down, and not project further than necessary beyond the side of the car. The brake shaft is held in place by the swivelling seat at the lower end of the bracket casting and by a clip at the upper end of the bracket. This clip is removable to allow the shaft to swing to a horizontal position.

Brake Shaft Step.—The brake shaft step will be malleable iron, and will be secured to end sills by the intermediate truss rod and one ⅝-inch bolt through the sill. The swivelling part will be of wrought iron and so made that the part on which the brake shaft rests will form its own rivet and turn at least 90 degrees. There is also one ⅝-inch bolt passing vertically through the end sill and the dog on the top of the floor.

Steps and Handholds.—There are two sill steps located at the brake shaft end of the car; there are two 22-inch handholds located, one at each end of the car on the opposite side of the uncoupling lever, and two 14-inch handholds located, one each at the outside of the uncoupling lever. The sill step is secured

with ⅝-inch lag screws, 4½ inches long, and the handholds are secured with ½-inch lag screws, 2½ inches long.

Foundation Brake.—All wheels are provided with brakes. The arrangement of the foundation brake is shown on the drawings, and the details of rods, levers, guides, clamps, etc., are also shown.

Air Brakes.—The brake is the Westinghouse quick acting air brake, and located as shown on the foundation brake drawings. The following air brake equipment will be furnished by the Railway Company: Brake cylinder, reservoir, triple valve, drain cup, couplings, with hose complete, angle cock, cut out cock, release valve, as per Westinghouse Company's schedule H-1. The pipes, clamps, etc., must be furnished by the builder. All joints in the piping and fittings must be put together with red lead, and in no case, will work be accepted unless the pipe screw going into the fitting, will take four or more threads. They must be thoroughly tightened and well screwed to the frame of the car. Test of same must be made, with 70 lbs. air pressure; all cars must be charged, and application made on or before leaving the shops.

Sample Castings.—A set of sample castings will be furnished by the Railway Company, and all castings used in the construction of cars must equal in weight and correspond in dimensions with the samples furnished. The initial letters of the Railway Company, together with its pattern numbers, must appear distinctly on every casting. All castings must have the shop or trade marks of builder cast upon them, for future identification of castings.

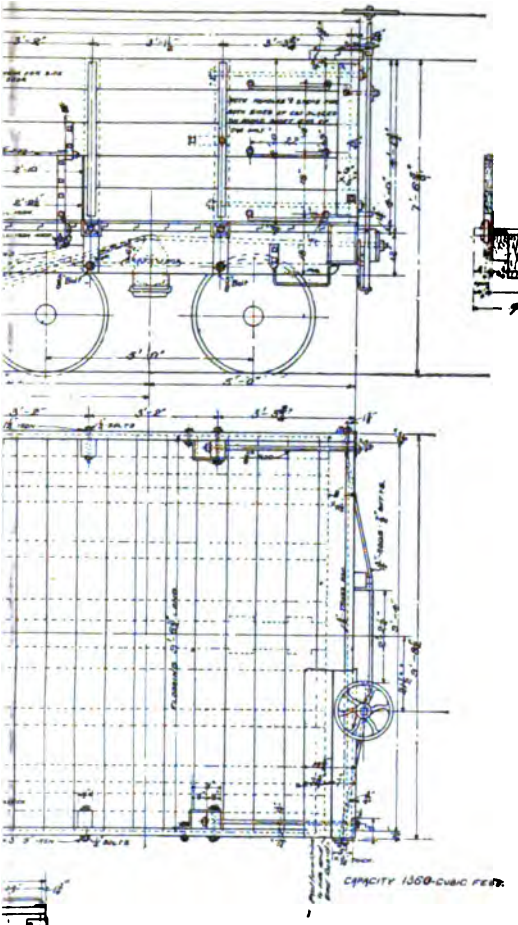
Mortises and Tenons.—All mortises and tenons, tenon shoulders, and butting joints, the top face of all sills are to receive one heavy coat of standard wood preservative creosote paint before they are put together.

Bolts and Nuts.—All bolts and nuts are to have United States standard thread, cut to work on the Railway Company's samples which will be furnished by the Railway Company. All bolts must be tightly riveted on the outside, or thread crushed to prevent the nuts from working off.

Painting.—The cars must be painted with three coats of the Railway Company's standard No. 1 mineral paint; iron work, where exposed to receive one coat of asphaltum black. The lettering must be the Railway Company's standard; number, weight, length, and date is stenciled on the side, as shown on the drawings. Pounce patterns for lettering will be furnished by the Railway Company.

Forged Iron.—The iron used for corner bands and buffing irons, will be subject to surface inspection only.

Trucks.—Drawings and specifications for Railway Company's high freight truck, for cars of 80,000 pounds capacity, accompany and form a part of these specifications.



GENERAL PLAN—GONDOLA CAR.

80,000 LBS. CAPACITY.

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General Instructions.—All materials which enter into the construction of cars built under these specifications, must conform to them fully in weight, size and quality. The work is to be done in a thorough and workmanlike manner, and the material and workmanship are subject to inspection by a representative of the Railway Company at all times. Companies or individuals furnishing materials for these cars, or those who are building them, must furnish all facilities to expedite the inspection of material and workmanship.

It is the intention that these written specifications and the drawings which form a part thereof, shall harmonize in every particular. Any necessary change from them or the drawings, or any discrepancies which may be found should be reported at once to the Superintendent of the Car Department, in writing, for decision.

All specifications and drawings for 40-foot flat car bodies which have been issued by this company prior to this date, are null and void, to prevent mistakes they should be returned to the company.

Low Drop Bóttom Gondola Car.—The Gondola car is a step in advance of the flat car as the platform is surrounded by side-planks either permanently attached or removable or hinged. Gondola cars are used mostly for the transportation of lumber and coal and are provided according to the service they are placed in with various appliances to facilitate the handling of the freight such as hopper bottoms and inclined floors for coal, etc.

SPECIFICATIONS FOR LOW DROP-BOTTOM GONDOLA CAR, 80,000 POUNDS CAPACITY.

The drawings accompanying these specifications, and forming a part of the same, are as follows:

General Plan.
Wood Details.
Wrought Details.
Cast Details.
Lettering.
Draft Rigging.
Air Brakes.
Air Brake Details.

GENERAL DIMENSIONS.

Length over end sills	36′	0 ″
Width over side sills	8′	6 ″
Length inside of end planks	35′	7½″
Width inside of side planks	9′	4 ″
Height from top of rail to center of drawbar	2′	10½″
Height of side planks	4′	0 ″
Cubical capacity	1360′	0 ″

The following supplementary specifications for materials will form a part of these specifications:

(1.) Specifications for the purchase of Wrought Iron.
(2.) Specifications for the purchase of Mild Steel.
(3.) Specifications for the purchase of Helical Springs.

The following articles will be furnished by the Railway Company, free of charge, at the works of the builder:

(1.) Drawbar Springs.
(2.) Automatic Couplers.
(3.) Air Brakes.
(4.) Paint stock of all kinds ready for use.

Framing.—All longitudinal sills are of long leaf Southern pine, sound and clear; one corner may be sappy, but not to exceed 1½ inches wide. End sills, cross-tie timbers, buffer blocks, side and end stakes, and air brake cylinder blocks are of white oak, of suitable quality for the purpose intended. The bolster filling blocks are of white oak; the side and end boards are of Norway pine, free from sap, and of suitable quality, all framed as shown on the detail drawings.

Flooring.—Is either long leaf Southern or Norway pine, 1¾ inches in thickness, ship lapped on the edge to match the Railway Company's standard. It must not be less than 4 inches nor more than 8 inches in width. In laying, wide and narrow pieces must alternate. It must be surfaced on one side and nailed to the sills with 30-penny cut nails. Pieces from 4 inches to 6 inches in width shall be nailed at each sill with two 30-penny nails, staggered. Pieces from 6 to 8 inches wide shall be nailed at each sill with three 30-penny nails, one of which may be driven blind.

Buffer Blocks.—The two oak buffer blocks are 4⅞ inches by 10½ inches and 2 feet 2½ inches in length, gained and bored as shown on drawings. They are bolted to end sills with three ¾-inch bolts with nuts placed outside, and one ¾-inch by 10-inch lag-screw as per drawing. They are also held in place by the two center truss rods.

Cross Tie Timbers.—Are 4½ inches by 12 inches by 8 feet

6 inches long; they are bored in a manner, as to secure them to the sills. The truss rod queen posts are secured to the same by means of bolts passing through the sills.

Body Bolster and Filling Blocks.—There are four sub-sill bolster blocks 5 inches by 4½ inches by 27 inches that are held in place by ¾-inch bolts and two 7¾ inches by 9 inches by 3 feet 11⅛ inches oak filling blocks placed between the center sills. There are six blocks 4½ inches by 9 inches by 27⅛ inches which are placed between the center and intermediate sills. These are to rest directly over the cross-frame tie timbers; all are shown on drawing.

Tie Rods.—There are nine Tie Rods ¾ inches in diameter increased to ⅞ inches, 3 inches in length on each end, passing through side posts and placed on top of sills, and two at each end of car through body, one of which is a truss rod. There are also eight ⅝-inch rods securing end boards to body of car.

Side Planks.—Are of Norway pine 2¼ inches thick, 9½ inches wide and 36 feet long. They are bolted to side stakes and corner irons with ½-inch bolts, which will have wrought iron washers under bolt head on inside and ¼-inch by 1½-inch by 45 inches strap iron for washers on outside of car at stakes. Bolts to be spaced as per drawing.

End Planks.—Are of Norway pine 2¼ inches thick and 9 feet 4 inches long, of the same width as used on the sides. They are secured to the end stakes and to the corner plates with ½-inch bolts which will have wrought iron washers under head on inside and outside. The details are shown on drawing.

Side Stakes.—There are eighteen white oak side stakes, 4 inches wide by 5 inches thick at the middle and bottom, and 3 inches at top. Twelve of these are 5 feet 1¾ inches long, and six are 5 feet 10¾ inches long. The position of stakes and details are shown on drawings.

End Stakes.—There are four white oak end stakes 4 inches by 3½ inches, two 4 feet 7½ inches long and two 4 feet 11½ inches. The lower ends extend to end sills and are secured to same by ¾-inch bolts and lag screw. The side stakes are prevented from spreading by means of ¾-inch rods extending across the car and through malleable iron washer plates on the outside edge of the stake, forming stake pockets.

Body Bolsters.—Is the Z bar type, riveted together with ¾-inch rivets and built up as shown on drawings.

Side Bearings.—There are two malleable iron side bearings to each bolster; each bearing is to bear on the bottom side of the body bolsters. Each side will be riveted to the bolster with four 3-inch rivets. The distance from center to center of the side bearing is 5 feet and 0 inches.

Drop Doors.—There are four maple drop doors placed cross-

wise of car at center. They are hung from the cross frame center ties by hinges and operated by a winding shaft, connected to doors by chains. For location of doors and details see drawings.

Side Doors.—There are two side doors placed at diagonal corners of car, 19 inches wide by 2 feet 9½ inches long, hung by hinges as shown in detail.

King Bolts.—There are two king bolts, 1⅞ inches in diameter by 17 inches long, provided in the center with a ring, ¾ inch in thickness by ¾ inch in width, as indicated by drawings.

Truss Rods.—There are six longitudinal truss rods, 1¼ inches in diameter increased to 1½ inches in diameter, 5 inches in length at each end. They are in two lengths, connected 18 inches from the middle with wrought iron turnbuckles of a satisfactory make; the turn-buckles are connected in pairs with a strip of wood, of suitable dimensions, through the openings in the turn-buckles to prevent them from turning. The wooden strip is to be secured so that it cannot get out of place. The truss rod washers which bear against the end sills of the car, are of malleable iron. The truss rod queen posts must be of malleable iron, secured to the cross center ties and sills by ¾-inch bolts. The center bearing will be provided with shelves on which will be placed a 2-inch plank, separating them lengthwise of car. Plank to be secured to shelf by ⅜-inch bolts at each end of plank. The posts are provided with a split key or other means of preventing the truss rods from falling in case of breakage.

Draw Bars and Pockets.—The draw bars are M. C. B. standard, and are furnished by the Railway Company. The pockets for same are ⅞-inch by 4 inches iron, and riveted to the drawbar by two 1⅛-inch ulster iron rivets, leaving the ends of the pocket to be formed as shown on the drawing, and be driven into the recesses of the drawbar while the ends of the pocket are hot. After they have been drawn together and properly riveted, the lugs on the ends must be drawn down under the hammer until they fill the space between the lugs of the drawbar.

Draw Bar Springs.—Are the Railway Company's standard and will be furnished by the Railway Company.

Draw Bar Stop Castings.—The draw bar stop castings or housing castings are malleable iron in two pieces, each piece to be bolted to the sill with eight ¾-inch bolts, and secured further from longitudinal motion by being let into the sills 1 11/16 inches. The follower plate carrier irons are ½ inch by 2 inches, the followers 1½ inch by 6 inches by 9 inches, placed in position as shown in the drawings. The carrier iron is ¾ inch by 3 inches. The end sill reinforcing piece is 1 inch by 4 inches.

The draw bar stop and other castings forming the draft rigging is known as the Williamson & Pries patent, and the right to manufacture and use the same is owned by the Railway Company. No royalty will be charged to car builders.

Corner Plates.—There are four corner plates for the sides, 3/16 inch thick by 10 inches by 3 feet 9 inches long, bent in the center to extend 5 inches on the end and side. They are secured to the end and sides with ½-inch bolts. They are further secured by means of rods as shown on drawings.

Brake Shaft.—The Brake Shaft is of 1¼-in h round iron, with bottom end 1½ inches in diameter. It is to rest in a malleable iron step secured to the end sill with ⅝-inch bolts. The brake Wheel is 17 inches in diameter and held to the shaft with ¾-inch nut; the end of the shaft is riveted over the nut. The upper brake shaft bracket is of malleable iron, and is secured to the end plank step with ⅝-inch bolts.

Lumber Stake Pockets.—There are eight lumber stake pockets made of wrought iron ½ inch by 2½ inches. Their location and shape is shown on the drawings.

Steps and Handholds.—There is one sill step, and three ladder handles located on each side of the brake staff end of the car, and two on the foot board, or platform, as shown on the drawings. There are also two handholds located on each end of the car, 24 inches from the bottom of the sill. The sill step is secured with ⅝-inch lag screws 4½ inches long, and the handles with ½-inch button-head bolts.

Foundation Brake.—All wheels are provided with brakes. The arrangement of the foundation brake is shown on the drawings, and the details of rods, levers, guides, clamps, etc., are shown on the detail drawings.

Air Brakes.—The air brake is the Westinghouse automatic quick-acting air brake, and located as shown on the foundation brake drawings. The following air brake equipment will be furnished by the Railway Company: Brake Cylinder, reservoir, triple valve, drain cup, couplings with hose complete, angle cock, cut-out cock, release valve and retaining valve, as per Westinghouse Company's Schedule H-2. The pipes, clamps, etc., must be furnished by the builder.

Sample Castings.—A set of sample castings will be furnished by the Railway Company, and all castings used must be equal in weight, and correspond in dimensions with the samples furnished. The initials of the Railway Company, together with the pattern number, must be plainly cast on every piece. All malleable iron castings must have the shop or trade marks of maker cast upon them, for future identification of castings.

Mortises and Tenons.—All mortises and tenons, tenon

shoulders, and butting joints, top face of all sills, and the edges of the side plank are to receive one heavy coat of the Railway Company's Standard wood preserving creosote paint before they are put together.

Bolts and Nuts.—All bolts and nuts are to have U. S. standard thread, and to correspond with samples which will be furnished by the Railway Company. All bolts must be tightly riveted on the outside, or thread crushed to prevent nuts from working off.

Painting.—The car must be painted with three coats of Railway Company's standard No. 1 mineral paint; the iron work, where exposed, to receive one coat of asphaltum black. The lettering is to be done with the Railway Company's standard No. 17 paint. The full name, trade mark, number, weight, length and date is stenciled on the side as shown on the drawings. Pounce patterns for the lettering will be furnished by the Railway Company.

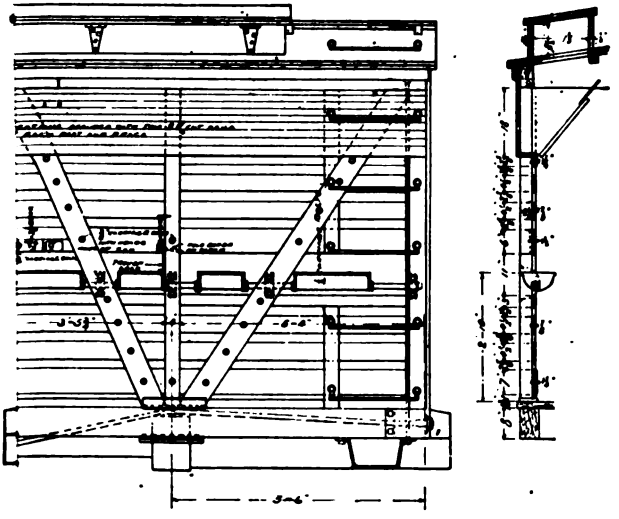
Wrought Iron and Steel.—Irons used for corner pieces, ratchet wheel plates and end sill stiffening irons must be of good quality, and subject to surface inspection only.

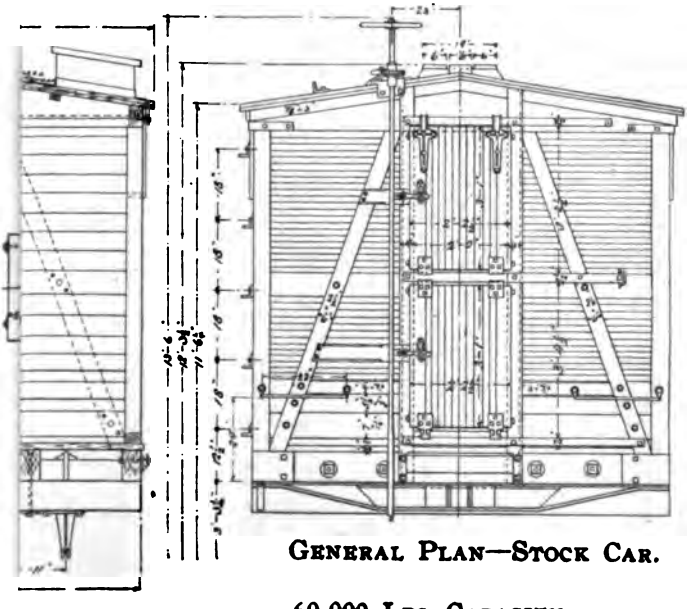
Trucks.—Drawings and specifications for Railway Company's low freight trucks for cars of 80,000 pounds capacity, accompany and form a part of these specifications.

General Instructions.—All material which enters into the construction of cars built under these specifications must conform to them fully in weights, size and quality. All work must be done in a thorough and workmanlike manner, and the material and workmanship are subject to inspection by a representative of the Railway Company at all times. Companies or individuals furnishing material for these cars, or those who are building them, must furnish every facility to expedite the inspection of material and workmanship. It is the intention that these written specifications, and the drawings that form a part thereof, shall harmonize in every particular. Any change from the specifications or drawings, or any discrepancies which may be found should be reported at once to the Superintendent of the Car Department, in writing, for decision.

All specifications and drawings for low drop bottom Gondola car bodies, of 80,000 pounds capacity which have been issued by the Railway Company, previous to this date, are null and void. To prevent mistakes they should be returned to the Railway Company.

Stock Car.—This vehicle is designed, as its name implies, for transporting live animals. It is roofed but is not tightly enclosed at the ends and sides. Sometimes it is double decked for the carriage of





GENERAL PLAN—STOCK CAR.

60,000 LBS. CAPACITY.

the smaller animals as hogs and sheep and is usually provided according to state regulations with appliances for feeding and watering the stock.

SPECIFICATIONS FOR 36-FOOT SPECIAL STOCK CAR, 60,000 LBS. CAPACITY.

The drawings referred to in these specifications, and forming a part of the same, are as follows:

Side and End Elevation and Floor Plan.
Doors.
Cast Details.
Wrought Details.
Lettering.
Wood Details.
Malleable Iron Draft Rigging.
Air Brake.
Air Brake Details.
Trucs, General Plan.
Truck, Cast Details.
Truck, Wrought Details.

The following supplementary specifications for material will form a part of these specifications.

1. Specifications for the Purchase of Wrought Iron.
2. Specifications for the Purchase of Mild Steel.
3. Specifications for the Purchase of Helical Springs.
4. Specifications for the Purchase of Car Axles.
5. Specifications for the Purchase of Truck Channels.
6. Specifications for the Purchase of Cast Iron Wheels.
7. Specifications for the Purchase of Iron Chains.

The following materials will be furnished, free of charge at the works of the Builder, by the Railway Company:

1. Draw Bar Springs.
2. Automatic Couplers.
3. Air Brakes.
4. Paint Stocks of all kinds ready for use.
5. Plastic Roofing Paper.

GENERAL DIMENSIONS.

Length over sills	36	feet	7	inches
Length inside	36	"	0	"
Width over sills	9	"	0	"
Width inside	8	"	5	"
Width over eaves	9	"	6½	"
Height inside, floor to carlines	7	"	¾	"
Height of draft line	2	"	10½	"
Cubical capacity	2,140	"		

Framing.—The side, intermediate and center sills, side plates and ridge pole, are of long leaf Southern pine; the carlines and the draft timber reinforcing pieces may be made of Southern pine, free of sap and knots, or of white oak of such quality as is suitable for the purpose intended. The end sills, end plates, draft timbers, cross center ties, deadwood blocks, posts and braces, and belt rails must be made of white oak of suitable quality. The longitudinal sills must be sound and clear; one corner may be sappy, but not to exceed 1½ inches in width or thickness. In framing this sill with sap, the sappy edge must always go downward.

The longitudinal sills are framed into the mortises of the end sills with double tenons, 1¾ inches in length by 1½ inches in thickness, the full width of the thickness of the sill, except the side sills which are relished 2 inches at the outside. Midway between the side and intermediate sills, resting on the needle beams, is a white oak timber, 2½ inches by 8 inches wide and 9 feet 6 inches long, toenailed to the needle beams, located in front of door as shown on drawings, and nails through the floor into them support the floor at the door openings. The longitudinal sills rest on the top of the top body bolster plates, and between the sills, lying lengthwise of the bolsters, are placed blocks of suitable length that fit closely between the sills. The braces of the car must be of such length as to fit tightly between the post, sill and plate, when the car is jacked up in the center and at the ends to the proper camber. Long leaf Southern pine must be used in all cases where Southern pine is mentioned.

Draft Sills.—Are of white oak, 5½ inches by 7 inches and 5 feet 7⅜ inches long; each is gained out on the top edge to receive one cast-iron draft timber key, and the top flange of body bolster, on the side to receive the draw bar stop castings. There are reinforcing pieces, 5 inches by 5 inches, extending from bolster to needle beam and between needle beams which form the continuous draft timbers to resist the buffing strains. There are six ¾-inch bolts, and twelve ¾-inch lag screws, 8 inches long, securing these timbers to the center sills, all as shown on drawings.

Buffer Blocks.—The two buffer blocks are of white oak, 5½ inches by 8 inches thick and 2 feet 4 inches in length, beveled on the top face and gained on the lower front edge to receive the wrought buffing angles. The details are shown on the drawing. They are bolted to the end sill with four ¾-inch bolts. The back face of the buffer blocks and both faces of the ⅞-inch filling pieces, between the blocks and the end sills, where they come in contact, must have a heavy coat of wood preservative paint before the blocks are secured in position.

Cross Center Ties.—Or needle beams are 4½ inches in thickness by 8 inches in width and 9 feet long. They are bored in such a manner as to secure them to the side, intermediate and center sills. The truss rod queen posts are secured to them by lag screws and bolts passing through the sills.

Side and End Plates.—The side plates are of Southern pine, 3¼ inches by 6 inches, mortised and bored to receive the side and door posts and side rods. The end plates are of white oak, 3 inches by 13½ inches, and are secured to the side plates by tenons 1¼ inches deep.

Carlines.—There are twelve carlines of white oak or Southern pine, free of sap and knots, 1¾ inches in thickness and 11 inches at their widest point, as shown on the drawing. Each end of the carline is mortised into the side plate 1¼ inches deep.

Ridge Pole.—Is of Southern pine in one length, 1¾ inches in thickness by 4 inches, shaped on the top edge to the proper pitch of the roof. It must be securely nailed to each carline and each plate with two 3½-inch spikes.

Purlines.—Are of white oak, straight in the grain and free from knots, and may be made in two lengths, the joints must be staggered; or if of Southern pine, they must be in one length, free of sap and knots, 1¾ inches in thickness by 2½ inches in width. They are to be securely nailed to each carline and each end plate with two 3¼-inch spikes.

Braces.—Body or counter braces may be of white oak or Southern pine, 2½ inches by 6 inches. The end braces may be of the same material, 2½ inches by 6 inches in width, framed to such length and shape as to fit tightly in the openings when the car is properly cambered.

Corner Posts.—Are of white oak, 4⅝ inches by 4¼ inches, 7 feet 9½ inches long.

Body and Ladder Posts.—Are of white oak, free of sap and knots, 2½ inches in thickness by 4 inches wide and 7 feet 1 inch long. The ladder posts are in three pieces, 2½ inches by 3¾ inches.

Door Posts.—The side door posts are of white oak, 4 inches by 3⅜ inches and 7 feet 1 inch long. The distance between the side door posts is 5 feet. The end door posts are of white oak, 4 inches by 4¼ inches and 8 feet 8 inches long. The distance between them is 2 feet. Except corner posts, all posts rest in cast iron pockets secured to the sills.

Flooring.—Is either Southern or Norway pine, 1¾ inches in thickness, shiplapped on the edges to match the Railway Company's standard. It must be not less than 4 inches nor more than 8 inches wide. It must be surfaced on one side and nailed to the sills with 30-penny nails, staggered; 4-inch

and 6-inch boards to have two nails to each sill and 8-inch boards to have three nails to each sill.

Sheathing.—Is of dry white pine or Oregon fir, first-class in quality, matched and grooved to the Railway Company's standard, with small V-shaped grooves on its face, 1¾ inches from center to center. Heart cuts which are liable to split or shell out must be omitted. It is placed on the outside of side posts and on the inside of the end posts, and is dressed on two sides to 27/32 of an inch in thickness and 5¼ inches in width; it is to extend across the posts, must be in one length and must be nailed to each post and brace with two 8-penny nails to each piece. The ends are sheathed from end plate to lower girth; and the sides are sheathed from eaves down the sides 18 inches from bottom of side plate, to form the letter board, with bottom finished as shown.

Roofing.—Is dry white pine, free from sap, dead knots and shaky places. The under course is of "B" or "first common" grade, 27/32 of an inch thick, by 5¼ inches wide, surfaced on both sides, matched and grooved; each piece is nailed to the plate, purlines and ridge pole with not less than three 8-penny nails at each place, one nail to be driven blind. One heavy coat of No. 1 mineral paint is then to be applied to the top of the roof, over which will be placed a layer of plastic roofing paper, which will be furnished by the Railway Company. The top course of boards is first-class siding, 27/32 of an inch thick by 5¼ inches wide, matched and grooved with two half round grooves worked in top face. It is nailed with three 10-penny cut nails in the same manner as the lower roof, and must be cut off to project 1½ inches over the fascia boards on the side. The plastic roofing must be laid in such a manner as to have it cut off with the boards. Care must be taken in securing the roof not to drive any of the nails so that they will miss plates, carlines or ridge poles. The quality of lumber as indicated in these specifications will be found in Judson's Revised Edition of the Lumbermen's Hand Book of 1891, "Chicago Yard Grading of Pine."

Hay Box.—Above the racks on either side of the car are openings in the main roof 18 inches wide; the length as shown on the drawings. These openings are covered with hinged covers raised 8½ inches above the main roof, and when in place they have the same slope as the roof, and form the hay box. The long sides of the hay box are of white pine 1¼ inches by 8½ inches. They are secured to vertical pieces 9 inches wide, two of which at each carline make up the width of the box. These vertical pieces are of white pine 1¾ inches thick, they are gained ¼-inch over each carline and have a ⅞-inch by 5 inches pine strip across the top. That part of the main roof which is back of the hay boxes is covered by No.

26 galvanized iron, passing under the running board; and the edges are flanged 3 inches deep at the upper side of each box. The galvanized iron is carried around the other side and the two ends of the hay box 3 inches high on the box and 2 inches wide on the roof of the car.

Hay Box Cover.—The covers for the long hay boxes are in two lengths and for the short hay box in one length. The covers on the long hay boxes are hung at the outside with two 8-inch strap hinges each, and the one cover on the short hay box is hung at the outside with three 8-inch strap hinges. One end of these strap hinges is secured to the outside face of the side of the box, and the other end to the under side of the cover, two ¼-inch bolts with washers and two No. 16 wood screws being used in each end of the hinge. The cover is in two thicknesses of roof boards, the under course extending lengthwise of the cover, and the top course extending crosswise of the cover, or parallel with the roof boards. Covers are kept from opening beyond a vertical position by a 3/16-inch chain 18 inches long, and are locked in position by hasp, hook and staple as shown on drawing.

Water Troughs.—There are 28 malleable iron watering troughs for each car. These troughs are connected and grouped as shown on drawing by 1¼-inch pipe nipples with a jam nut at each connection. Each group of troughs is separated by wrought iron boxes, one to each post or brace. The nipples in the outside end of each group of troughs is closed with a 1¼-inch pipe cap. Each group of troughs is to be held in an open or closed position by a stop as shown in detail.

Fascia Boards.—The side and end fascia boards are of pine, of suitable shape, ⅞ inch thick by 3 inches wide, and nailed to the plates.

Running Boards.—Are of clear white or Norway pine, free from knots, sap and shaky places. The middle board is 2¼ inches thick by 6 inches wide, shaped to fit over the ridge of the roof, and notched to receive the running board cleats, and is secured to the roof with two 3-inch No. 18 screws at each cleat, and two No. 18 screws midway between the cleats. The two side pieces are 1¼ inches thick by 6 inches wide, and secured to each cleat by two 8-penny nails. The cleats are of white oak, 1¾ inches thick, shaped to fit the pitch of the roof. They are secured over each carline and end plate, and nailed to the roof with four 30-penny nails to each cleat. The cleats must be bored for the nails. Before the running boards and cleats are applied, the roof must be given a heavy coat of Railway Company's standard No. 1 paint underneath the cleats and running boards.

Girths.—There are two girths of white oak; one 6 inches by 1½ inches, the lower edge of which is 3 feet 4½ inches from

top of sill. The other is 7 inches by 1¼ inches and its lower edge is 2¾ inches from top of sill. The two girths extend around four sides of the car, except at the side doors, and the lower girths at the end doors. They are secured with one ⅜-inch carriage bolt, head inside, and two No. 16 wood screws to each post and brace. The middle girth is gained ¼-inch deep at posts and braces.

Slats.—Are of white oak, ⅞ of an inch thick. They are surfaced on both sides and both edges, the inside edges are rounded; they are fastened to the inside of the braces with one ⅜-inch carriage bolt to each brace. They are secured to the posts by two 8-penny nails in each post. The top slat is 18 inches from the lower face of the side plate.

Side Doors.—Are frame doors; the stiles are of white oak, 4½ inches by 1¾ inches, 7 feet 1 inch long. The doors are 5 feet 2½ inches wide; the top and middle rails are 6 inches by 1¾ inches, and the bottom rail is 9 inches by 1¾ inches, 4 feet 8½ inches long. They are mortised into the stile and have joint bolts passing through stiles and protection strips. Between the ends of the lower rails and the middle of the center rail, there are two diagonal braces, 4 inches by ⅞-inch and 3 feet 8 inches long. The slats are mortised into the stiles and are secured to each diagonal brace and stile with two 1½-inch No. 14 screws. On the two side edges of the stiles are protecting strips, 1¾ inches by ¼ inch, secured with No. 18 screws, spaced 5 inches. The doors are to receive one heavy coat of the Railway Company's standard No. 1 paint on the back side. The hangers are the Railway Company's standard malleable iron, secured with three ⅜-inch carriage bolts and one 1½-inch No. 18 screw, as shown on the drawings. The handle is secured by six 1½-inch No. 14 screws, located as shown.

End Doors.—Are batten doors; the outside sheathing is vertical and is the same as used on the side of the car; the two end pieces of the outside sheathing are of white oak, ⅞ inch by 5½ inches, 3 feet 1 inch long. The inside pieces are 5½ inches wide over tongues. There are four end doors per car and they are 2 feet 2½ inches wide and 3 feet 1 inch long.

End Door Tracks.—Are of wrought iron; the upper track is ¼ inch by 2½ inches wide and 4 feet 6½ inches long, bolted to the end plates with three ½-inch bolts (counter sunk head) passing through the track, brackets and plate. The bottom track is ¾ inch by 2 inches and 5 feet 2 inches long, bolted to the end door posts and brace with three ½-inch bolts passing through the track, brackets and end posts or brace. The middle end door track is 2½ inches by ⅜ inch, 4 feet 8½ inches long, and is bolted to the end door posts, brace and girth with ½-inch bolts.

Side Door Tracks.—The top side door track is ¼ inch thick by 2½ inches wide and 10 feet 6 inches long; it is secured to the side plate by eight ½-inch bolts passing through the track, filling pieces and side plates. The bottom track is ⅜ inch thick by 2 inches in width and 10 feet 6 inches in length, secured to the side of the car by eight ½-inch bolts passing through the track, brackets and sill of the car.

Door Stops.—The closed door stop for the side door is of white oak, 2½ inches thick by 2½ inches wide and 7 feet long. It is secured to the door post by four ½-inch bolts with nuts sunk flush with the inside of the car. The closed door stop for the end door is of white oak, 4 inches by 4 inches; the upper end is 1 foot 1 inch long, and the lower one is 2 feet 1 inch long. The open door stop is of cast-iron, and for end doors is bolted to the middle door track.

Door Fastenings.—The end and side doors are locked with Railway Company's standard car door fastenings.

Door Thresholds.—The upper end door threshold is of white oak, 4 inches by 4¼ inches and 2 feet 3 inches long; the bottom threshold is 5 inches by 7¼ inches and 2 feet 8 inches long. On the bottom threshold is a piece of wrought iron, 3/16 of an inch thick by 4 inches in width and 24 inches long, secured to the same by eight No. 14 screws, 1½ inches long. The side door threshold is 3 inches thick by 4 inches in width, beveled on top inside edge, and 5 feet in length.

Body Bolsters.—Are the Z bar type, riveted together with ¾-inch rivets, and built up as shown on drawings.

Body Bolster Blocks.—There are eight body bolster blocks to each car, 7 inches by 10 inches, and of lengths to suit the spacings between the sills. They are placed on the top member of the bolster between the side, intermediate and center sills, held in place by body bolster and truss rods. They are of white oak or yellow pine, and are used to furnish the supports for the truss rod seats.

Side Plate Tie Rods.—There are eight ⅝-inch round iron plate tie rods, extending to the outside of the plates immediately beneath the carlines, to prevent the side plates from spreading. They are grooved into the bottom edge of the carlines 11/16 inch deep and are secured to the carlines at the middle by 3/16-inch staple, 2½ inches long, driven into the bottom edge of the carline. The ends of the rods must be riveted over the nuts.

Plate and Sill Rods.—There are eighteen ¾-inch tie rods extending through sills and plates. The rods for the end posts are grooved into them.

Side Bearings.—There are two malleable iron body side bearings to each bolster; each bearing is to bear on the bottom of the body bolster.

King Bolts.—There are two king bolts, 1⅞ inches in diameter by 17 inches long. They are provided in the center with a ring, ¾ inch thick by ¾ inch in width, as indicated by drawings.

Truss Rods.—There are four truss rods, 1¼ inches in diameter, increased to 1½ inches in diameter, 5 inches in length on each end. They are in two lengths, connected in the middle with wrought iron turnbuckles of a satisfactory make; each turnbuckle is connected with adjacent one with a strip of wood, of suitable dimensions, through the openings in the turnbuckle, to prevent them from turning. The wood strip is secured so that it cannot get out of place. The truss rod washers, which bear against the end sills of the car, are of malleable iron, as shown on the drawings. The truss rod queen posts are shown on the drawings, and must be of malleable iron and secured to the needle beams by ⅝-inch lag screws, 4½ inches in length.

The posts are provided with split keys or other means to prevent the truss rod from falling in case of breakage.

Hay Racks.—Are of white oak, 20½ inches wide. They are made up of two long strips, 3 inches wide by 1¼ inches thick, with two strips 3 inches wide by 1¼ inches thick across the ends, making up the complete frame. The intermediate slats are 2½ inches wide by ¾ inch thick, 1 foot 8½ inches long, and are spaced 6 inches apart; they are mortised into the long rails. The racks are secured to the counter brace, transom post, body post and body brace with bolt-hinges, and the other side is supported by ¼-inch chain, 16 inches long, secured to the side plate with a ½-inch lag screw, 3 inches long.

Cattle Bars.—Are of white oak 7½ inches wide at the middle and 6 inches at the ends, and 1⅝ inches thick, 5 feet 1½ inches long; when placed before the door they are supported in mortises in the door posts. One ¼-inch chain 15⅜ inches long secures each bar to the door post with one ½-inch bolt and to bar with one ⅜-inch eye bolt, with all nuts well riveted over. When cars are being unloaded, bars are to be carried on wrought iron brackets, which are secured to the side of the car. When bars are in position of door the lower edge will be 3 feet 2¾ inches from top of floor.

Draw Bars and Pockets.—The draw bars are M. C. B. standard and are furnished by the Railway Company. The pockets for same are of ⅞-inch iron, and riveted to draw bars with two 1⅛-inch Ulster iron rivets, leaving the ends of the pockets to be formed as shown on the drawing, and to be driven into the recess of the draw bar while the ends of the pocket are hot. After they have been drawn together and properly riveted, the lugs on the ends must be drawn down under the hammer until they fill the spaces between the lugs of the draw bar.

Draw Bar Springs.—Are the Railway Company's standard Class H and Class I, and will be furnished by the Railway Company.

Draw Bar Stop Castings.—The draw bar stop or housing castings are of malleable iron in two pieces, each piece bolted to the draft timber with eight ¾-inch bolts and secured further from longitudinal motion by being let into the draft timber 1 11/16 inches.

The draw bar guides are ½ inch by 2 inches, the followers 1½ inches by 6 inches by 9 inches placed in position, as shown on the drawings. The carrier iron is 1 inch by 4 inches. The draw bar, stop and other castings forming the draft rigging is known as the Williamson-Pries patent, and the right to manufacture and use the same is owned by the Railway Company. No royalty will be charged to car builder.

Corner Plates.—At each outside lower corner of the car is a corner plate, ¼ inch thick by 8½ inches in width, extending 12 inches on the side of the car and 10 inches on the end of the car. They are bolted to the end and side sills with ⅝-inch bolts. The upper corner plate is ⅜ inch in thickness by 2 inches in width and 11½ inches on each leg. They are secured to the plates by bolts and straps, as shown on the drawings.

Sill Steps.—There are two sill steps of wrought iron, ⅜ inch by 2 inches, shaped as shown on the drawing; each is secured to the under side of the sill, directly under the center of the ladder, with one ⅝-inch lag screw, 4½ inches long, and the corner post rod.

Ladders.—The ladders on the side of the two diagonal corners of the car are made up of five handles to a side and one on the roof, of ⅝-inch round iron, 22 inches in length, and are fastened to the corner post and ladder post with ½-inch lag screws, 3 inches long and ½-inch carriage bolts as shown on drawing. There are two on each end of the car 24 inches from the bottom of the sill. These serve as hand-holds and are secured with ½-inch lag screws, 3 inches in length.

Brake Shaft.—Is of 1¼ inch round iron with bottom ends 1½ inches in diameter; it rests on a wrought iron step secured to the end sill with two ⅝-inch bolts. The brake wheel is 17 inches in diameter and held on the shaft with a ¾-inch nut; the end of the shaft is riveted over the nut. The upper brake shaft bracket is of gray iron and is secured to the plate with two ½-inch bolts with nuts outside of car, and to the roof with two ⅝-inch lag screws. The location of the brake shaft is shown on the drawing.

Foundation Brake.—All wheels are provided with brakes. The arrangement of the foundation brake is shown on draw-

ing, and the details of the rods, levers, guides, clamps, etc., is shown on detail drawings.

Air Brake.—The air brake is the Westinghouse automatic quick acting freight brake, and is located as shown on the foundation brake drawings. All joints in the piping and fittings must be put together with red lead, and in no case will work be accepted unless the pipe screw going into the fitting will take four or more threads. They must be thoroughly tightened and well secured to the frame of the car. Test of same must be made with 70 pounds air pressure. All cars must be charged and applications made on same before leaving the shops.

The following air brake equipment will be furnished by the Railway Company: Brake cylinder, reservoir, triple valve, drain cup, couplings with hose complete, angle cock, cut-out cock and release valve, as per Westinghouse Company's schedule H-1.

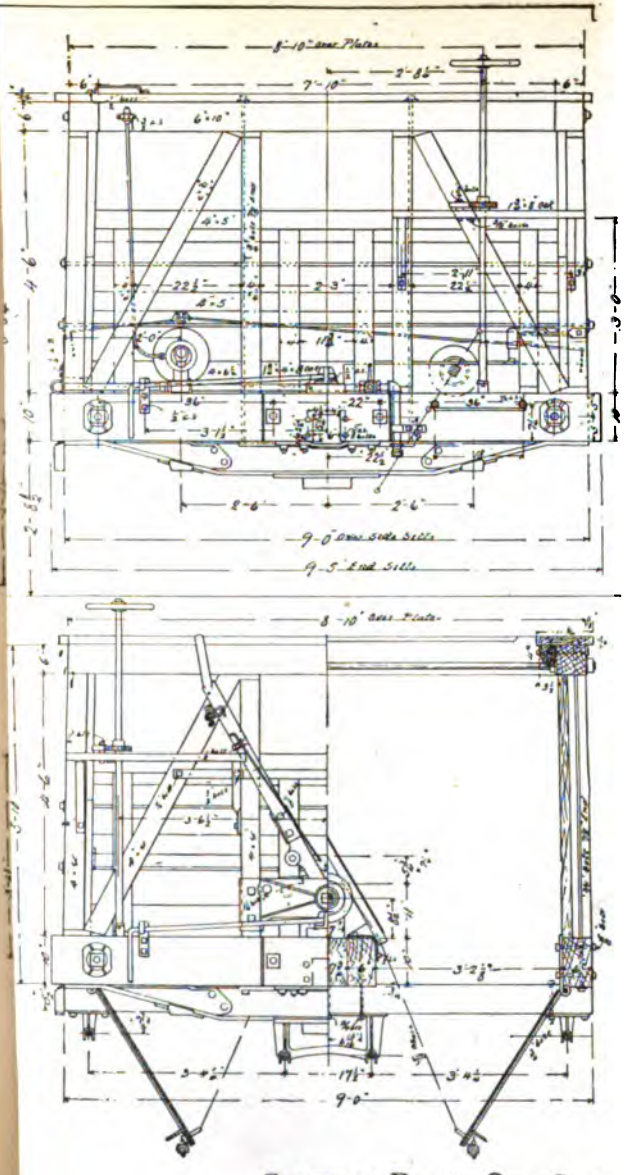
Wrought Iron.—Used in the construction of the following parts will be subject to surface inspection only, and the requirements of the physical test will be waived: Corner irons of all kinds, side and end door tracks, side and end door protecting strips.

Sample Castings.—A set of sample castings will be furnished by the Railway Company, and all castings used on the cars must be equal in weight and correspond in dimensions with the samples furnished. The initials of the Railway Company, together with the pattern number, must be plainly cast on every piece. All castings must have the shop or trade marks of maker cast upon them for future identification of castings.

Mortises and Tenons.—All mortises and tenons, tenon shoulders, butting joints of braces and posts, sills, etc., the top and outside face of the side and end sills, the top and outside face of the side plates are to receive one heavy coat of the Railway Company's wood preserving creosote paint.

Painting.—Cars are to be painted on the outside with three coats of the Railway Company's standard No. 1 mineral paint. There is to be no blacking off of the iron work. The edges of the top and bottom courses of roof boards are to receive one coat of No. 1 mineral paint before being laid. The first course of the roof is to receive one coat of No. 1 paint before the plastic paper is applied. The exterior of the car must not be painted oftener than once in twenty-four hours. The body of the trade mark is the Railway Company's standard No. 26 paint. The lettering for the cars is the Railway Company's standard No. 17 paint.

Pounce patterns for all lettering, trade marks, etc.,



GENERAL PLAN—ORE CAR.

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will be furnished by the Railway Company. The draft timbers immediately under the end sill must be stenciled, "Patented July 28, 1896 and March 9, 1897." The body bolsters must be stenciled "Patented September 18, 1900."

Bolts and Nuts.—All bolts and nuts are to have the U. S. standard threads and correspond with samples which will be furnished by the Railway Company.

Trucks.—Drawings and specifications for Railway Company's standard No. 1 truck for 60,000 lbs. cars, accompany and form a part of these specifications.

General Instructions.—All material which enters into the construction of cars built under these specifications must conform to them fully in weight, size and quality. All work must be done in a thorough and workmanlike manner, and the material and workmanship are subject to inspection by a representative of the Railway Company at all times, and companies or individuals furnishing material for these cars, or those who are building them, must furnish every facility to expedite the inspection of the material and workmanship. It is the intention that these written specifications, and the drawings which form a part thereof, shall harmonize in every particular. Any change from the specifications or the drawings, or any discrepancies which may be found, should be reported at once to the proper official in writing, for decision. All specifications and drawings for special stock car bodies, which have been issued by the Railway Company prior to this date, are null and void. To prevent mistakes, they should be returned to the Company.

SPECIFICATIONS FOR ORE CAR, 80,000 LBS. CAPACITY.

Ore Car.—The drawings referred to in these specifications, and forming a part of the same are as follows:

General Plan and End Views.
Wood Details.
Wrought Details.
Cast Details.
Draft Rigging.
Lettering.

The following supplementary specifications for material will form a part of these specifications:

Specifications for the purchase of Wrought Iron.
Specifications for the purchase of Mild Steel.
Specifications for the purchase of Helical Springs.

The following materials will be furnished, free of charge at the works of the builder, by the Railway Company:

1. Draw Bar Springs.
2. Automatic Couplers.
3. Air Brakes.
4. Paint stocks of all kinds ready for use.

GENERAL DIMENSIONS.

Length over end sills	21′ 6½″
Length inside, top	19′ 1½″
Length inside, bottom	5′ 6″
Width over side sills	9′ 0″
Width inside, top	7′ 10″
Width inside, bottom	8′ 0″
Height inside	6′ 0″
Height of draft line	2′ 10½″
Cubical capacity	584 cu. ft.

Framing.—The side, center and sub-center sills, side and end plates, and the side boards are Southern pine. The end sills, buffer blocks, cross center tie must be of white oak of suitable quality. The center sills are to be gained out on inside face for the draw bar stop casting. The longitudinal sills must be sound and clear, one corner may be sappy, but not to exceed 1½ inches in width or thickness; in framing this sill with sap, the sap edge must always go downward. The end sills are framed into the mortises of the side and center sills with double tenons, 1¾ inches in depth by 1½ inches in thickness, and 6 inches in length. The braces of the car must be of such length as to fit tightly between post, sills and rail when the car is jacked up in the center and on the ends to the proper camber.

Buffer Blocks.—The two oak buffer blocks are 3⅝ inches by 10 inches thick, and 2 feet 3 inches in length. The details are shown on drawings. They are to be secured to the end sills with two center truss rods. The back face and the front face of end sill, and buffer blocks, where they come in contact, must have a heavy coat of wood preservative paint before they are secured in position.

Cross Center Ties.—Or needle beams, are 6 inches in thickness by 6 inches in width and 9 feet in length. They are gained ½ inch on top face for side and center and sub-center sills. They are bored in such a manner as to secure them to side and intermediate sills. The truss rod queen posts are secured to them by means of ¾-inch bolts.

Side Rails.—Are of Southern pine, 6 inches by 6 inches and 20 feet 10 inches long, mortised and bored to receive side posts and side rods, end rail and deck beams. The end rails must be yellow pine, free of knots, 6 inches by

10 inches and are to be secured to side rails by means of tenons 1½ inches deep and ¾ inch rods, one at each end, as shown on the drawings.

Side Boards.—The side boards are Southern pine, 1¾ inches, dressed and shiplapped, 20 feet 9½ inches long. They are spiked to the side post and braces with 20-penny spikes, as shown on drawings.

Braces.—Body or counter braces must be of yellow pine 4 inches by 4½ inches. The end braces may be of the same material, 4 inches in thickness by 4½ inches in width, framed to such length and shape as to fit tightly in the openings when the car is properly cambered.

Posts.—Are of yellow pine, 4 inches by 4 inches by 4 feet 5⅜ inches long, and are set in malleable iron shoes as shown on drawings.

Flooring.—The flooring is maple, 1¾ inches thick and 9 feet 2 inches in length, one end resting on the cross timber and the other on the deck beam, as shown on drawings. Care must be taken that a tight fit is made at the sides and ridge at center of car.

Running Boards.—On top of each side plate and spiked to same is a 1¾-inch by 11¾-inches yellow pine plank, projecting over outside face of plate 1½ inches and supported on inside by a 3½ inches by 4-inch block fastened to side plate by ½-inch bolts.

Doors.—The drop doors are wrought plates ⅜ inch by 37½ inches and 5 feet 5 inches; they are provided with wrought iron eye-bolt hinges and are held shut by the drop door shaft and chain, as shown on the drawings.

Body Bolster.—Is the Z bar type, riveted together with ¾-inch rivets and built up as shown on drawings.

Bench Caps.—Are of oak 6 inches wide by 5¼ inches thick and 9 feet 1 inch long, gained at ends to rest on side plates and wrought iron saddles secured with one ½-inch bolt at each end.

Side Tie Rods.—There are ten ¾-inch tie rods with ⅞ inch ends extending crosswise of car and one 1½-inch tie rod placed under bench cap and secured to side plates with nuts and cast washers placed on both sides of each plate.

Rail and Sill Rods.—There are eighteen ¾-inch tie rods with ⅞-inch ends extending through the sills and rails. The rods for the body posts are grooved into them.

Side Bearings.—There are two malleable iron body side bearings to each bolster; each bearing is to bear on the bottom side of the body bolster. Each side bearing will be riveted to the bolster with four ¾-inch rivets. The distance from center to center of the side bearings is 5 feet.

King Bolts.—There are two king bolts, 1⅞ inches in diameter by 17 inches long. They are provided in the center with a ring, ¾ inch in thickness by ¾ inch in width, as indicated on the drawings.

Truss Rods.—There are four truss rods 1½ inches in diameter, increased to 1¾ inches in diameter, 5 inches in length on each end, 11 feet 6¼ inches when straight, and four 1¼ inches truss rods increased to 1½ inches in diameter, 5 inches in length on each end, 11 feet 2 inches long when straight, connected in the middle with wrought iron turnbuckles of a satisfactory make; the truss rod washers, which bear against the end sills of the car, are malleable iron, as shown on the detail drawings. The truss rod queen posts are shown on the detail drawings, and are secured to the needle beam by ¾-inch bolts. The posts are provided with a spit key, or other means, to prevent the truss rods from falling in case of breakage.

Couplers.—The couplers are the M. C. B. standard and are furnished by the Railway Company. The pockets for same are of ⅞-inch by 4-inch iron, and riveted to the couplers with two 1⅛-inch ulster iron rivets, leaving the ends of the pocket to be formed as shown on the drawing, and to be driven into the recess of the coupler while the ends of the pocket are hot. After they have been drawn together and properly riveted, the lugs on the ends must be drawn down under the hammer until they fill the spaces between the lugs on the coupler.

Draw Bar Springs.—Are to be Railway Company's standard class "H" and class "I" and will be furnished by the Railway Company.

Draw Bar Stop Casting.—The draw bar, or housing, castings are of malleable iron in two pieces, each piece is bolted to the center sill with eight ¾-inch bolts and secured further from longitudinal motion by being let into the draft timber 1 11/16 inches. The draw bar guides are ½ inch by 2 inches, the followers 1½ inches by 6 inches by 9 inches, placed in position as shown on the drawings. The carrier is ¾ inch by 3 inches. The end sill reinforcing plate is 1 inch by 4 inches. The draw bar stop and other castings forming the draft rigging is known as the Williams & Pries patent, and the right to manufacture and use same is owned by the Railway Company. No royalty will be charged car builders.

Sill Steps.—There are two sill steps of wrought iron ⅜ inch by 1¾ inches, shaped as shown on drawing; each step is secured to the outside of the side sill with four ½-inch lag screws, 4½ inches long.

Ladder.—There is a ladder on the side of the two

diagonal corners of the car made up of four handles to a side and one on the deck, of ⅝-inch round iron, 18 inches in length on the sides and 12 inches on the deck and fastened with ½-inch bolts and lag screws, 3 inches long. There is also one grab iron on each end of car placed on opposite side of car from ladder.

Brake Shaft.—Is of 1¼-inch round iron with bottom ends 1½ inches in diameter; it rests in a malleable iron step secured to the end sill with two ¾-inch lag screws. The brake wheel is 17 inches in diameter, and held on the shaft with ¾-inch nut; the end of the shaft is riveted over the nut. There is a brake shaft and a brake step at each end of the car. The location of the brake is shown on drawing.

Foundation Brake.—All wheels are provided with brakes. The arrangement of the foundation brake is shown on drawing, and the details of the rods, levers, guides, clamps, etc., are shown on drawings.

Air Brake.—The air brake is the Westinghouse automatic quick acting freight brake. All joints in the piping and fittings must be put together with red lead and in no case will work be accepted unless the pipe screw going into the fitting will take four or more threads. They must be thoroughly tightened and well screwed to the frame of car. Test of same must be made with 70 pounds air pressure. All cars must be charged and application made on same, before leaving the shops. The following air brake equipment will be furnished by the Railway Company: Brake cylinder, reservoir, triple valve, drain cup, couplings with hose complete, angle cock, cut-out cock, and release valve, as per Westinghouse Company's schedule H-1.

Sample Castings.—A set of sample castings will be furnished by the Railway Company, and all castings used on the car must be equal in weight, and correspond in dimensions with the samples furnished. The initials of the Railway Company, together with the pattern number, must be plainly cast on every piece. All malleable iron castings must have the shop or trade marks of maker cast upon them, for future identification of castings.

Mortises and Tenons.—All mortises and tenons, tenon shoulders, butting joints of braces and posts, sills, etc., the top and outside face of the side and end sills, top and outside face of the side and end rails, are to receive one heavy coat of the Railway Company's standard wood preserving creosote paint.

Painting.—The car must be painted with three coats of the Railway Company's standard No. 1 mineral paint. The iron work where exposed, to receive one coat of black asphaltum paint. The exterior of the car must not be

painted oftener than once in twenty-four hours. The lettering for the cars is the Railway Company's standard No. 17 paint. The location and arrangement of lettering is shown on drawing. Pounce patterns for all lettering will be furnished by the Railway Company.

Bolts and Nuts.—All bolts and nuts are to have the U. S. standard threads, and to correspond with the samples which will be furnished by the Railway Company.

Trucks.—Drawings and specifications for the Railway Company's low freight truck of 80,000 lbs. capacity accompany and form a part of these specifications.

General Instructions.—All material which enters into the construction of cars built under these specifications must conform to them fully in weight, size and quality. All work must be done in a thorough and workmanlike manner, and the material and workmanship are subject to inspection by a representative of the Railway Company at all times, and companies or individuals furnishing material for these cars, or those who are building them, must furnish every facility to expedite the inspection of material and workmanship. It is the intention that these written specifications and the drawings that form a part thereof, shall harmonize in every particular. Any change from the specifications, or drawings, or any discrepancies which may be found, should be reported at once to the proper official in writing, for decision. All specifications and drawings for ore cars which have been issued by the Railway Company prior to this date, are null and void. To prevent mistakes, they should be returned to the Company.

CHAPTER VII.

DRAFT GEAR AND COUPLERS.

The method of attaching car to car in order to make the connected line of vehicles a complete train is, it will readily be supposed, a matter of prime importance. It is a matter that in marked degree affects the structure of the car. Not only does the safe movement of the train depend upon it but the act of coupling or detaching cars is one involving danger to human life. Hence much thought has been given to the devices that should be adopted.

The subject has received the attention of Congress and the "Safety Appliance Acts" provide, amongst other things, that "it shall be unlawful for any * * * common carrier to haul or permit to be hauled or used on its line any car used in moving interstate traffic not equipped with couplers coupling automatically by impact and which can be uncoupled without the necessity of men going between the ends of the cars." The law also made provision for the fixing of a standard height for drawbars for freight cars. The heights so prescribed are: Standard-gauge roads, 34½ inches; narrow-gauge roads, 26 inches; maximum variation between loaded and empty cars, 3 inches.

The term draft gear embraces the whole combination of draft attachments and coupler attachments. It includes draft timbers, automatic coup-

lers, draw bar housings, uncoupling arrangement buffer blocks, and dead wood.

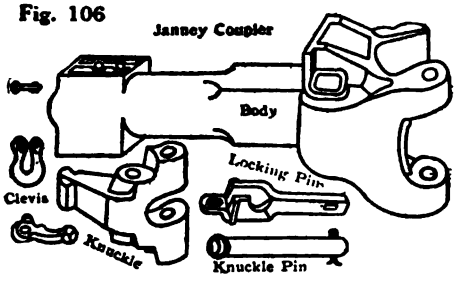
Draft Timbers.—(Plate I, No. 53.) There are two of these members. Their purpose is to carry the draw bar housings and transmit the pull to the car framing; they are placed below the center sills and extend from the dead wood (Plate I, No. 57) to the body bolster or through the bolster to the butting timber (Plate I, No. 56). They are usually of white oak if wood is used, the dimensions varying according to the character and capacity of the car. Often they are of steel and at times they are entirely omitted, the draw bar housings being attached directly to the center sills. With steel cars of course they are made of the same material as the remainder of the car framing.

Automatic Couplers.—The automatic coupler as adopted by the Master Car Builders' Association is simply one of outline as illustrated in Figure 105. The shank, however, is of standard dimensions throughout. As regards the mechanism of the coupling details all that is required to be standard is the general outline of the parts. This required outline is shown by the Form of Contour line in Figure 105. As a check on the finished coupler the coupler and knuckle limit gauges as shown in the same illustration are used.

There are many kinds of couplers in use which are strictly M. C. B. standard, each one being designed with different methods for opening, closing and locking the knuckle in place. The original automatic coupler was the Janney which is shown in Figure 106. Among the others commonly in use may be mentioned the Buckeye, Chi-

cago, Detroit, Erie, Gould, Hien, Little Delaware, Lone Star, Mather, Missouri Pacific Talbot, Peerless, Pooley, St. Louis, Solid, Standard, Tower, Trojan, Washburn and Williams, all of which are illustrated diagrammatically in Fig-

Fig. 106



ures 107 to 107*q* inclusive. These are only a few of the many in use, the different kinds of bodies and knuckles, each approximating close to the one hundred mark.

Because of the fact that these various couplers all conform to the standard contour lines, they

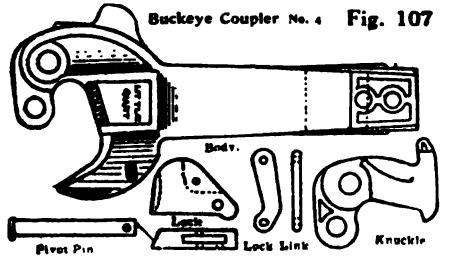


Fig. 107

are each capable of being operated in connection with any one of the remainder. As a further means of having couplers uniform the following specifications have been recommended by the Master Car Builders' Association:

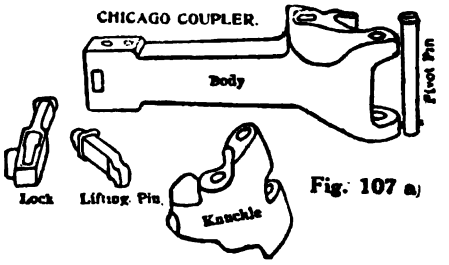


Fig. 107 a

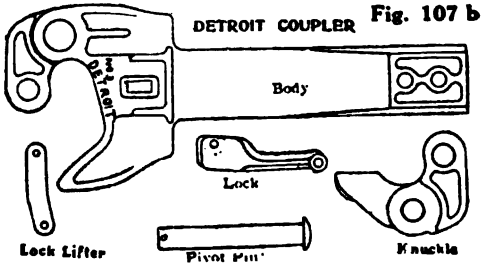


Fig. 107 b

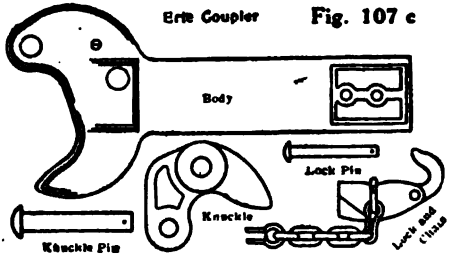


Fig. 107 c

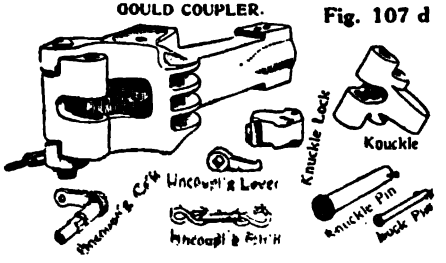
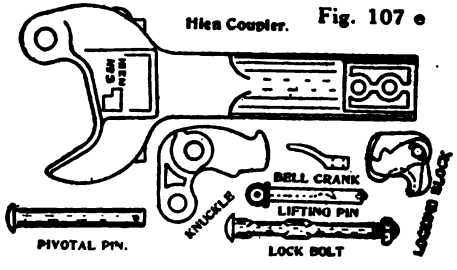
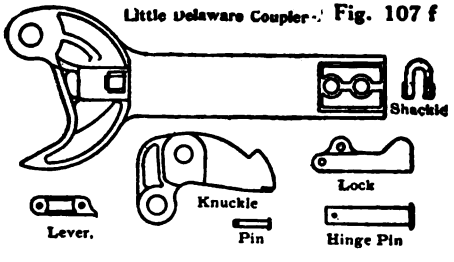


Fig. 107 d

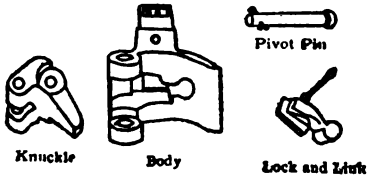
Hien Coupler. **Fig. 107 e**



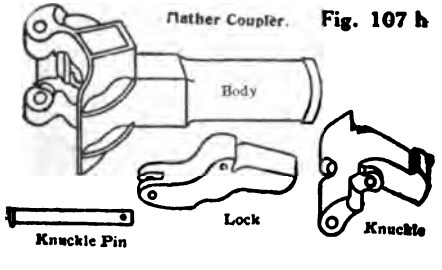
Little Delaware Coupler. **Fig. 107 f**



Lone Star Coupler **Fig. 107 g**



Nather Coupler. **Fig. 107 h**



Missouri Pacific Talbot Coupler.

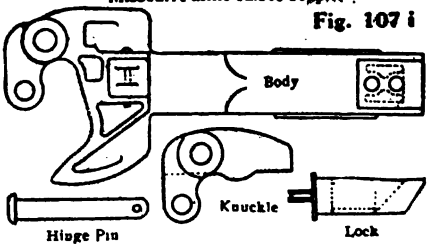


Fig. 107 i

Peerless Coupler

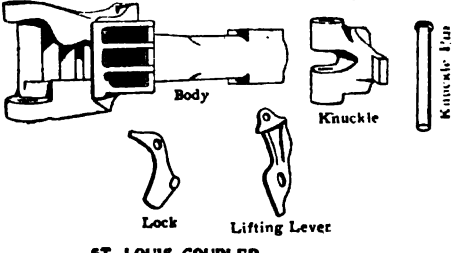


Fig. 107 j

ST. LOUIS COUPLER.

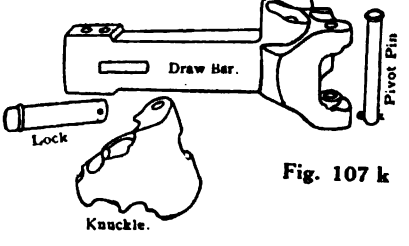


Fig. 107 k

Solid Coupler

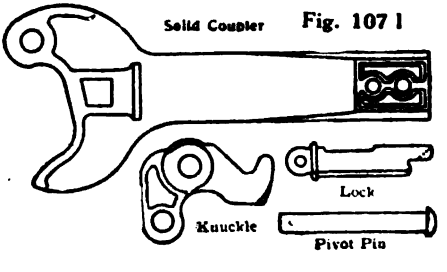
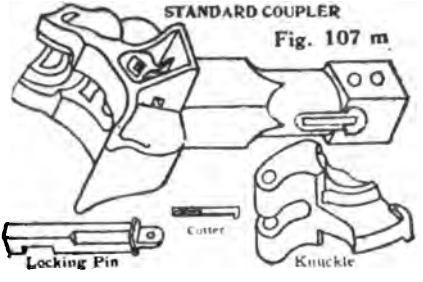


Fig. 107 l


STANDARD COUPLER
Fig. 107 m
Cotter
Locking Pin
Knuckle

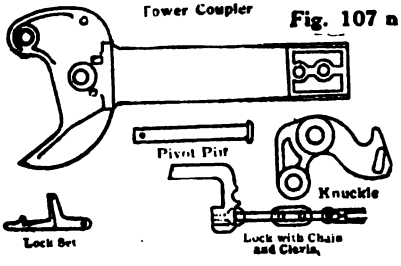
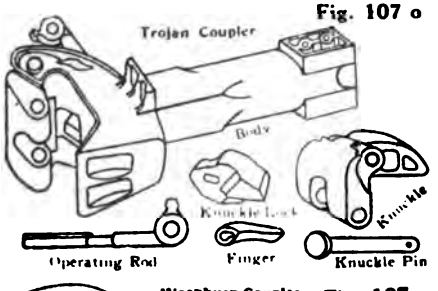
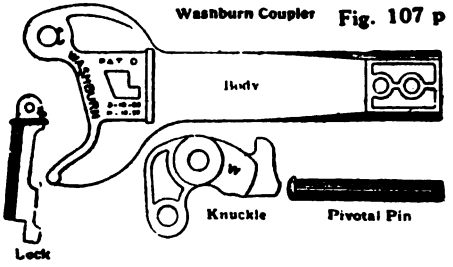

Tower Coupler
Fig. 107 n
Pivot Pin
Knuckle
Lock Set
Lock with Chain and Cleris

Fig. 107 o


Trojan Coupler
Body
Knuckle Lock
Knuckle
Operating Rod
Finger
Knuckle Pin


Washburn Coupler
Fig. 107 p
Body
Knuckle
Pivotal Pin
Lock

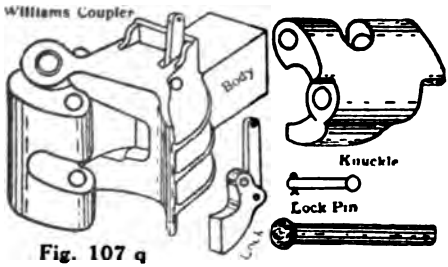


Fig. 107 q

SPECIFICATIONS FOR M. C. B. AUTOMATIC COUPLERS.

The couplers furnished under this specification must be made of steel in accordance with the best foundry methods and must not be painted.

1. Couplers will be subject to the inspection and test of the above named company as to their mechanical workings, general condition and strength. The tests and inspection will be made at the place of manufacture, where assistance and labor necessary to make satisfactory and prompt inspection and shipment must be furnished free by the manufacturer. The testing machine and gauges approved by the M. C. B. Association must be used in the test and inspection of couplers.

2. Couplers will be ordered as far as practicable in lots of one thousand; for each one thousand ordered the manufacturer shall furnish 1,014 and in the event of additional couplers being required to carry out the prescribed tests, they shall be furnished free of cost by the manufacturers.

3. Bars, knuckles and locking pins or blocks must be accurately made to gauges furnished by the manufacturer. These gauges must govern all dimensions representing fitting surfaces, thereby insuring absolute interchangeability and freedom of motion between the assembled parts without further adjustment or machining. When assembled, knuckles and locking pins or blocks must work freely, but the lost motion between knuckles and bars must not permit more than ⅛ inch vertical play, or between knuckles and locks must not permit the knuckle to drop forward beyond the proper contour line, but ¼ or ⅜ of an inch lost motion in opposite direction is desirable.

4. Couplers must conform to M. C. B. contour lines and must have a lock set within the head of the coupler. They must couple and uncouple with each other (with either or both knuckles open) and also with the master or sample coupler; they should lock easily when the knuckle is

pushed in by hand. They must, unless written permission to the contrary be given, have steel pivot pins 1⅝ inches in diameter of sufficient length to permit applying a ⅜-inch cotter pin through the pin below the coupler lug. Pivot pins, after having the heads struck up, must be properly annealed.

5. Bars and knuckles shall not be accepted if distorted by improperly matched flasks or any other defects due to molding. They must be free from injurious shrinkage cracks, flaws, checks, sand, sand holes or blow holes. The holes for pivot pins in lugs of bars and knuckles should be drilled or, if cored, must be broached out, and must not be more than 1/16 inch larger than pin. The holes must be parallel to the face of the bar or knuckle and at right angles to the axis of bar or knuckle. As many bars and knuckles as possible must be cast from the same heat of steel. All parts must be well annealed throughout.

6. The pulling and contract faces of coupler and knuckle must be clean, smooth and at right angles to axis of the bar. The dimensions of butt and shank must be within the limits of variation shown by the company's drawing.

7. The name of coupler must be legibly cast on the top side of head of the bar. Each knuckle and each draw bar must bear a serial number legibly stamped or cast upon it. The knuckle must also bear the name of the coupler and the manufacturer's name or identification mark legibly cast or stamped at some point where it will not be worn off.

INSPECTION.

1. The couplers, after having been thoroughly inspected by the manufacturer to see that they meet the requirements as to interchangeability, soundness and dimensions of parts, etc., herein specified, should be arranged in lots of 101 and 102, so as to provide for the necessary 1,014 couplers and, where possible, care should be taken to put all couplers of the same heat number or numbers in the same lot or lots. The inspector shall then inspect and gauge each coupler as to its compliance with drawing sizes, and for surface defects and proper contour lines. Any irregularities or swollen parts on the working or bearing faces must be ground or chipped off before the couplers are accepted.

After this inspection the inspector shall select one complete coupler taken at random from each of the lots as provided for above and subject them to test No. 1 hereafter specified. If the coupler fails to stand the prescribed tests but, before failing, stands a sufficient number of blows to make a retest admissible, a second coupler shall be taken from the same

lot from which the first coupler was taken. If it stands the test, that lot of couplers shall be accepted as far as test No. 1 is concerned; otherwise that lot of couplers shall be rejected and another lot substituted and tested in the same way.

2. From each 1,004 couplers accepted by test No. 1 four complete couplers shall be selected by the inspector, one of which shall be subject to test No. 2, one to test No. 3 and two to test No. 4, hereinafter specified. If any coupler or pair of couplers fails to stand the prescribed test, but, before failing, stands a sufficient number of blows to make a retest admissible, a second coupler or pair shall be taken from the same lot or lots from which the first were taken. For instance, if the couplers selected for the test No. 3 have been taken from the fourth one hundred couplers and the failure allows a retest, a second pair shall be taken from the fourth one hundred couplers. If they stand the test, that lot of one thousand couplers shall be accepted as far as that test is concerned; otherwise that lot shall be rejected and another lot of one thousand couplers substituted. Any part of any coupler which has been subjected to test is condemned for service.

PHYSICAL TESTS.

Test No. 1.—Striking Test on Closed Knuckle of Complete Coupler.—As a preliminary, the coupler must be marked on bottom of butt with a center-punched line parallel to axis of shank, this line to extend to the inner face of knuckle (see Fig. 108); the coupler must then be rigidly fixed in the machine in a vertical position, with the axis of coupler in the center line of drop, the pivot pin hole parallel to line through center of legs of the machine and the butt blocked solidly on the anvil to prevent lateral motion by means of steel fillers and wedges, the latter sledged down tight and this sledging repeated after each blow. The heights of support from bottom of butt end should not be greater than 19½ inches.

Blows to be struck directly on knuckle.
Three blows of 1,640 pounds falling five (5) feet.
Three blows of 1,640 pounds falling ten (10) feet.

The coupler shall be considered as having failed to stand this test if it is broken before it has received three blows at 5 feet and three blows at 10 feet, or if any cracks appear more than one inch long or open more than 1/16 inch, or the center-punched line measured at contour is distorted more than 1⅞ inches after having received three blows at 10 feet, or if the knuckle is closed more than ¾ of an inch

from its original position when pulled out against the lock by hand after receiving three blows at 5 feet, or if the knuckle will not open, or if the locking device is inoperative after test. For measuring axial distortion and knuckle closure, see Figs 108 and 109. Should the coupler before failing stand three blows at 5 feet and one blow at 10 feet, another complete coupler shall be provided and tested as per Section 8 governing retest.

Test No. 2.—Guard Arm Test of Drawbar.—As a prelim-

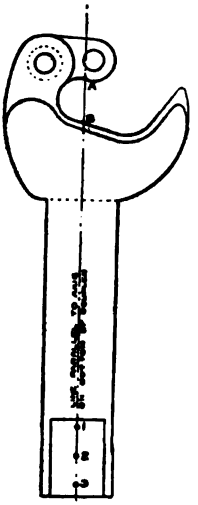


Fig. 108
BEFORE TEST

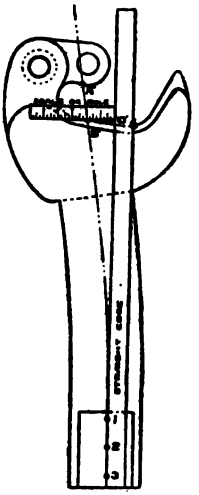


Fig. 109
AFTER TEST

inary, pivot, knuckle and locking device having been removed the coupler must be marked on bottom with a center-punched line (see points 1, 2 and 3 in Figs. 110 and 111 parallel to axis of shank and extending to the contour face, a center-punch mark must also be placed at the end of guard arm and on lug (see Fig. 110). The coupler must be blocked rigidly in a vertical position in the machine with steel fillers and wedges, the latter sledged down tight and the sledging repeated after each blow. The butt must rest solidly on the anvil and must be blocked to prevent lateral motion. The edge of guard arm must be on line through centers of legs of machine.

Blows to be struck directly on guard arm.
Three blows of 1,640 pounds falling three (3) feet.
Four blows of 1,640 pounds falling five (5) feet.

The coupler shall be considered as having failed to stand this test if it is broken before it has received three blows at 3 feet and four blows at 5 feet, or if any crack appears more than one inch long or open more than 1/16 inch, or if the center-punched line is distorted more than 1½ inches for 5 in. by 7 in. shank or 1⅞ inches for 5 in.

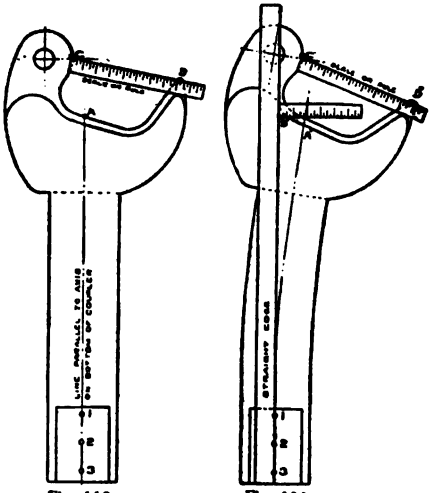


Fig. 110 BEFORE TEST

Fig. 111 AFTER TEST

by 5 in. shank couplers, or if the distance between center-punch marks on bottom of head has widened more than 7/16 inch. For method of measuring axial and guard arm deflection, see Figs. 110 and 111. Should the bar before failing stand three blows at 3 feet and two blows at 5 feet, another coupler shall be provided and tested as per Section 8 governing retest.

Test No. 3.—Jerk Test of Complete Couplers.—One coupler shall be placed in an inverted position in the yoke forging of test machine and equalizer bar placed so as to rest

level, one end in the closed knuckle, the other resting central on the spring follower cap. The weight must strike the equalizer bar midway between the center line of coupler and the center line of the spring follower cap.

Three blows of 1,640 pounds falling five (5) feet.
Three blows of 1,640 pounds falling ten (10) feet.

A coupler shall be considered as having failed to stand this test if it is broken before it has received three blows at 5 feet and three blows at 10 feet, or if cracks appear more than one inch long or open more than 1/16 inch, or if the kunckle is open more than ¾-inch from its original position after third blow at 10 feet, or if the equalizer bar will not stay in place when struck, or if the knuckle will not open, or if the locking device is inoperative after receiving the full test. Should the coupler fail to stand the prescribed test, but stand three blows at 5 feet and one blow at 10 feet, another complete coupler shall be provided and tested as per section 8 governing retest.

Test No. 4.—Pulling Test for Complete Couplers.—Two couplers shall be supported in the machine by yoke forgings and locked together as in running position, with their axis in the same straight line. The couplers must stand a steady pull of 120,000 pounds. A coupler shall be considered as having failed to stand this test if it is broken before it has been pulled the prescribed number of pounds, or if any cracks appear more than one inch long or open more than 1/16 inch, or if the knuckle has opened more than ¾-inch from its original position when pulled out against the lock. The measurement of knuckle opening must be obtained after the pressure is released. The couplers shall be considered as having failed to stand this test if they slip apart in the machine, or if the knuckle will not open, or if the locking devices are inoperative after above tests. Should either or both couplers fail to stand the prescribed test, but both stand 90,000 pounds, another complete coupler or pair of couplers shall be provided as per Section 8 governing retest.

The final failure of any part to meet test shall not condemn the complete coupler but only that part which fails, and such part in all couplers presented shall be replaced, after which the test shall be proceeded with, using new couplers, as if no part of the test had been made.

SPECIFICATIONS FOR SEPARATE KNUCKLES.

The knuckles furnished under this specification must be made of steel in accordance with the best foundry methods and must not be painted.

1. Knuckles will be subject to the inspection and test of

the above named company as to their general condition and strength. The tests and inspection will be made at the place of manufacture, where assistance and labor necessary to make satisfactory and prompt inspection and shipment must be furnished free by the manufacturer. The testing machine and gauges approved by the M. C. B. Association must be used in the test and inspection of knuckles.

2. Knuckles will be ordered as far as practicable in lots of 100; for each 100 ordered, the manufacturer shall furnish 102, and in the event of additional knuckles being required to carry out the prescribed tests, they shall be furnished free of cost by the manufacturers.

3. Knuckles must be accurately made to gauges furnished by the manufacturer. These gauges must govern all dimensions representing fitting surfaces, thereby insuring absolute interchangeability without machining.

4. Knuckles shall not be accepted if distorted by improperly matched flasks or any other defects due to molding. They must be free from injurious shrinkage cracks, flaws, checks, sand, sand holes or blow holes. The holes for pivot pins in knuckles should be drilled or, if cored, must be broached out, and must not be more than 1/16 inch larger than 1⅝-inch diameter pivot pin. The holes must be parallel to the face of the knuckle, and at right angles to the axis of knuckle. As many knuckles as possible must be cast from the same heat of steel. All parts must be well annealed throughout.

5. The pulling and contact faces of knuckle must be clean and smooth.

6. Each knuckle must bear a serial number and the manufacturer's name or identification mark legibly cast or stamped at some point where it will not be worn off.

INSPECTION.

7. The knuckles, after having been thoroughly inspected by the manufacturer to see that they meet the requirements as to interchangeability, soundness and dimensions of parts, etc., herein specified, should be arranged in lots of 102 and, where possible, care should be taken to put all knuckles of the same heat number or numbers in the same lot or lots. The inspector shall then inspect and gauge each knuckle as to its compliance with drawing sizes, and for surface defects and proper contour lines. Any irregularities or swollen parts on the working or bearing faces must be ground or chipped off before the knuckles are accepted.

After this inspection the inspector shall select two knuckles taken at random from the lot or lots as provided

for above, and subject one of them to Test No. 1 and the other to Test No. 2, hereafter specified. If one of these knuckles fails to stand prescribed Test No. 1, but before failing, stands a sufficient number of blows to make retest admissible, another knuckle shall be taken from the same lot from which the first knuckles were taken. If it stands the test, that lot of knuckles shall be accepted as far as Test No. 1 is concerned; otherwise that lot of knuckles shall be rejected and another lot substituted and tested in the same way.

The other knuckle selected by the inspector shall be subjected to Test No. 2. If this knuckle fails to stand prescribed Test No. 2, hereafter specified, but before failing, stands a sufficient number of blows to make a retest admissible, another knuckle shall be taken from the same lot from which the first knuckles were taken. If it stands the test, that lot of knuckles shall be accepted; otherwise that lot of knuckles shall be rejected and another lot substituted and tested in the same way.

PHYSICAL TEST.

TEST NO. 1. STRIKING TEST.

The striking test back block and knuckle supports are placed in the housing against the back and sides, the knuckle dropped in between the supports and held by inserting the pin through the holes in the knuckle supports. The knuckle is then adjusted by means of liners between the back block and the knuckle supports, and between the knuckle supports and the housing. The striking block is then placed in the housing casting resting upon the knuckle. A fitting piece made to suit the type of knuckle is slipped in position between the tail and housing casting so that the striking face of the knuckle is in a horizontal position.

Blows to be struck on striking block through which they are transmitted to knuckle.

Three blows of 1,640 pounds falling four (4) feet.
Three blows of 1,640 pounds falling eight (8) feet.

The knuckle shall be considered as having failed to stand this test if it is broken before it has received three blows at 4 feet and three blows at 8 feet, or if any cracks appear more than 1 inch long or open more than 1-16 inch. Should the knuckle before failing stand three blows at 4 feet and one blow at 8 feet, another knuckle shall be provided and tested as per Section 7 governing retest.

TEST NO. 2. JERK TEST.

The jerk test back block and knuckle supports are placed in the housing against the back and sides, the knuckle

dropped in between the supports and held by inserting the pin through the hole in the knuckle supports. The knuckle is then adjusted by means of liners between the back block and the knuckle supports, and between the knuckle supports and the housing. The striking block is then inserted resting on the inner face of the knuckle, and a block of suitable size inserted between the tail of the knuckle and striking block so that the striking face of the knuckle is in a horizontal position.

Blows to be struck on the striking block through which they are transmitted to the knuckle.

Three blows of 1,640 pounds falling three (3) feet.
Two blows of 1,640 pounds falling six (6) feet.

The knuckle shall be considered as having failed to stand this test if it is broken before it has received three blows at 3 feet and two blows at 6 feet, or if any cracks appear more than 1 inch long or open more than 1-16 inch. Should the knuckle before failing stand three blows at 3 feet, another knuckle shall be provided and tested as per Section 7 governing retest.

In connection with the testing of couplers and knuckles under the above specifications the testing machine as shown in Figure 112 is used. This is the M. C. B. Drop Testing machine. The Association has a machine of this kind at Purdue University, where all the official testing is done. The twist gauge shown in Figure 113 also is used on new couplers.

For determining the limit to which couplers can be worn without making them defective the gauge for worn M. C. B. couplers as recommended by the Master Car Builders' Association is used. This is shown in Figure 113, together with a combined gauge for Car Inspectors' use for Worn Coupler Limits and Defective Wheels. When this combined gauge will pass between the knuckle and the guard arm the coupler is defective and should be replaced immediately.

It is readily understood that when a knuckle is broken out the coupler is practically of

no use until a new one has been substituted. On account of the great number of couplers and knuckles in use it is practically impossible to always have on a train a knuckle to suit the individual case of breakage. With this idea in view an emergency knuckle has been designed which can be applied to any type of coupler body, and which will answer for all ordinary purposes until the train can reach a point where the proper knuckle can be obtained. This knuckle and its mode of operation is shown in Figure 114.

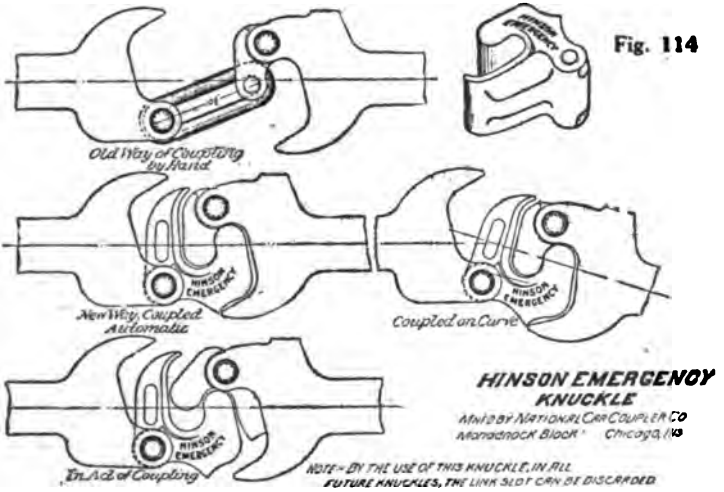
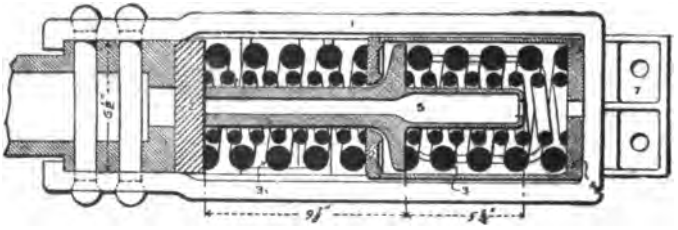

Old Way of Coupling by Hand
New Way, Coupled Automatic
Coupled on Curve
In Act of Coupling
HINSON EMERGENCY KNUCKLE
Mnf'd BY NATIONAL CAR COUPLER CO
Manhattan Block Chicago, Ill.
NOTE—BY THE USE OF THIS KNUCKLE, IN ALL FUTURE KNUCKLES, THE LINK SLOT CAN BE DISCARDED

Fig. 114

Draw Bar Housings.—In connection with the housings it is necessary to consider also the complete fastening or attachment of the coupler to the car. At the rear of the coupler is secured the pocket as shown in Figure 115 which is of sufficient dimensions to enclose the springs etc. of the particular type of draft gear. The coupler

is held up in place by the carrier iron *J* of figure 115 and the follower plates which extend through the pocket or yoke and engage the housings on the draft timbers. The recommended practice of the Master Car Builders' Association in this detail is also shown in this illustration which shows the draw bar in place and gives also the details of the different parts used.

Fig. 116



BUTLER DRAW BAR ATTACHMENT.

There are a great many patented forms of draft gears in use most of which have been developed with the idea of taking care of the great pull which comes on the draw bars of cars in long trains by some combination of springs. There are a large number however which are devised to make use of some sort of friction arrangement to absorb the heaviest strains only leaving springs to take care of the ordinary pulls. Of the former type the following few illustrations give an idea of the different schemes employed: Figure 116 shows the Butler gear; Figure 117 the Miner; Figure 118 the Solid; Figure 119 the Missouri; Figure 120 the Farlow; Figure 121 the American Continuous.

As an example of the friction gears may be mentioned the

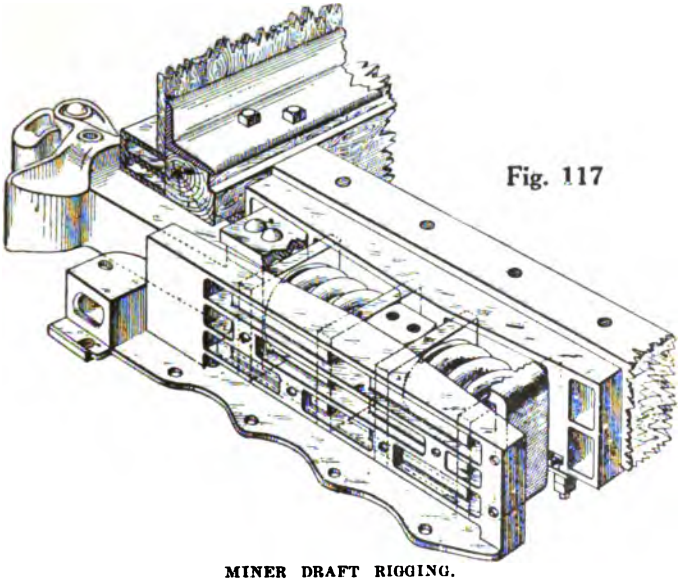
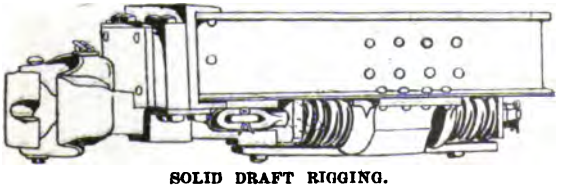


Fig. 117

MINER DRAFT RIGGING.

Westinghouse Friction Gear a view of which is shown in Plate X. The frictional device is

Fig. 118



SOLID DRAFT RIGGING.

placed within the yoke and between the followers in the usual manner. To accommodate the in-

creased diameter the yoke is widened, and when attached to the standard M. C. B. coupler, filling pieces are used, as shown in Figure 15. A coupler with the back end built up as shown in Figure 1, however, makes a simpler and cheaper arrangement. The inner follower plate, *A*, receives the pulling stresses from the yoke end; the outer follower transmits them to the draw-bar stops

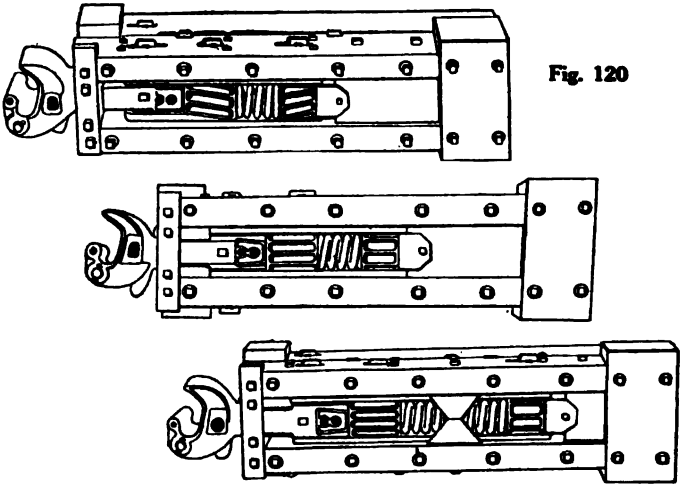
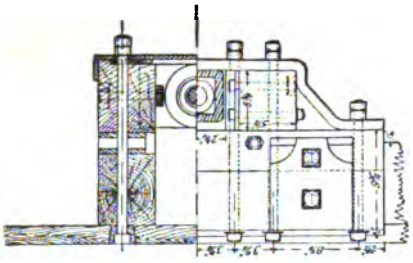


Fig. 120

FARLOW DRAFT GEAR.

and to the car framing. In the common form of draft gear the spring resistance is interposed between the follower plates; that is, the pulling and buffing stresses tend to reduce the distance between the follower plates, and these stresses are resisted by the springs which tend to hold the follower plates apart. This Friction Draft Gear acts precisely in the same way, but the resistance of springs it is claimed is supplement-



AMERICAN
CONTINUOUS ATTACHMENT
APPLIED TO
M.C.B. RECOMMENDED
DRAW GEAR. PLATE B.1896.

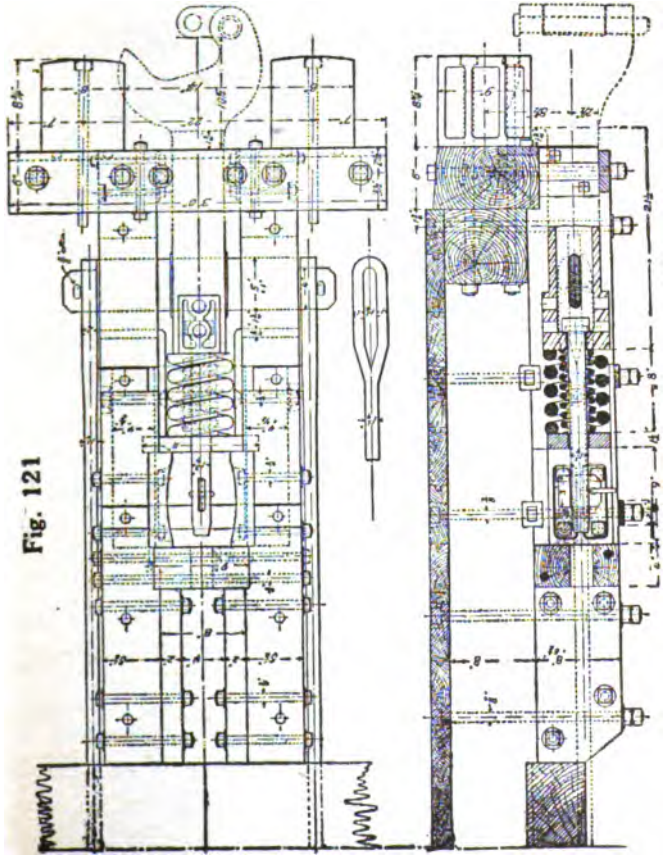


Fig. 121

ed by vastly greater frictional resistances both in pulling and buffing.

Bearing against the follower plate, *A*, is a spring, *C*, the other end of which bears against a wedge, *D*, made in the form of a frustum of an octagonal pyramid with hard brass facets, as shown in Fig. 1, Plate X.

Surrounding the wedge are four pairs of malleable-iron segmental carriers, *E*, having inclined bearing surfaces, *N*, of the same angle as the wedge, as shown in Figs. 2, 3, 4, 5 and 6, Plate X. These segmental carriers, *E*, have a central longitudinal rib, cast upon them to strengthen and guide them. These ribs fit the grooves, *F*, in Fig. 9, Plate X, loosely.

The other grooves of the frictional cylinders, Fig. 9, Plate X, are filled by the hardened wedge bars, *G*, Fig. 7, Plate X. The shape of these wedge bars is seen in Figs. 7 and 8, Plate X. They rest upon the segmental carriers *E*, as shown in the sectional views of Figs. 11 to 14, Plate X, with the small inwardly projecting portions, marked *H* in the lower view of Fig. 7, Plate X, engaging cavities in the carriers, *E*, so that if the carriers, *E*, are moved longitudinally to the right or left the wedge bars *G*, must move with them.

The function of the preliminary spring, *C*, Fig. 1, Plate X, is to force the wedge against the inclined surfaces, *N*, of the segmental carriers, and also to absorb the ordinary pressure on the draw bar due to the movement of the train. When the apparatus is placed in the yoke this spring is under a slight compression which insures the parts being held tightly in position, thus prevent-

ing foreign substances from lodging between the bearing surfaces. The auxiliary preliminary spring, *O*, Fig. 1, Plate X, gives additional pressure on the wedge. The main release spring, *K*, is used for returning the segmental carriers and wedge bars to their normal position after the force to close them has been removed, and it also gives additional capacity to the device. The function of the auxiliary spring, *L*, is to release the wedge, *D*; and the release pin, *M*, relieves the pressure of the auxiliary spring, *L*, against the wedge during frictional operation.

When either in draft or in buffing, the stress upon the drawbar moves the follower plates, *A* or *Z*, Fig. 1, Plate X, toward each other, the preliminary spring, *C*, is compressed, and if the pressure so applied is less than is required to force the follower plate, *A*, against the release pin, *M*, the segmental carriers and wedge bars remain at rest. The capacity of this spring is about 20,000 pounds and is sufficient to provide for a large percentage of the drawbar movements, thus greatly relieving the frictional element from motion and consequent wear. When, however, the stress exceeds the capacity of the preliminary spring sufficiently to push the follower, *A*, against the ends of the segmental carriers, it will have forced the release pin, *M*, which projects slightly above the segmental carriers, toward the closed end of the cylinder, thereby relieving the pressure of the auxiliary release spring against the small end of the wedge. In this position the force necessary to compress the springs, *C*, and *O*, is exerted against the large end of the wedge, and by the inclined surfaces it is transmitted through the segmental

carriers to the wedge bars. A further increase of force against the follower plate, *A*, puts the segmental carriers and wedge bars into motion, and in so doing the force exerted by the wedge upon the wedge bars produces friction between the wedge bars and the *V* shaped grooves of the cylinder (which is tapered toward the closed end). The traverse of the wedge bars is completed when the follower, *A*, comes in contact with the end of the cylinder, the release springs, *K*, and *L*, having been compressed to about 80 per cent of their capacity. The complete movement of both springs and frictional elements results in a total resistance of about 140,000 pounds.

On the removal of the pulling stress at the coupler, the springs, *C* and *O*, are restored gradually to their normal length. The preliminary release spring, *L*, then pushes the wedge back and away from the segmental carriers, and in this condition the main release spring, *K*, bearing upon the projections, *N*, of the segmental carriers, presses them to the left, which, when accomplished, withdraws all of the wedge bars from their positions in the grooves at the small end of the cylinder, constituting a complete release of the friction device.

The carriers, *E*, are arranged in pairs with interlocking outer ends, as shown in Figs. 2 and 3, in order to prevent them from being put together in wrong order. Each carrier contains two of the loose wedge bars, and the slots in the carriers in which the lugs of the wedge bars engage are of different lengths. In a set of two bars the first lug fits the slot, the second has 1-16 of an inch play,

the third ⅛ of an inch play, and the fourth 3-16 of an inch play, as indicated in Figs. 2 and 3, Plate X. This is also clearly shown in the four sectional sketches, Figs. 11 to 14, Plate X. If this is understood it will be clear that under the influence of the spring, *K*, the top wedge bar, Fig. 11, Plate X, will be released first, and the others in succession as the space in the slots is taken up. Four bars are represented by Fig. 11, Plate X, and when these are released the spring, *K*, releases four more represented by Fig. 12, Plate X, and so on. Since there are eight carriers in all, or four sets of two each, it is only necessary for the spring, *K*, to release the wedge bars four at a time until all are free.

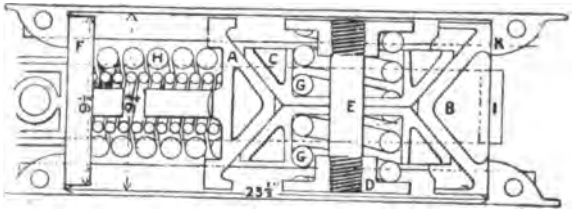
The operation of buffing is exactly similar to that of pulling, in that the follower plates are moved towards each other, but of course the load comes first upon the outer follower in this case. The application of the spring and friction resistances and the manner of fractional release are the same for pulling and buffing.

Another friction gear is the Republic shown in Figure 122.

Uncoupling Arrangements.—This is a very important part of the draft rigging because of the fact that upon its condition and action will depend the question as to whether the draw gear complies with the law in regard to the train men having to go in between the cars to uncouple them. It is therefore absolutely necessary to have this device always in the best possible condition and operative. The recommended practice of the Master Car Builders' Association is shown in Figure 115, which illustrates its application to different

types of car construction. It is of course necessary to have some arrangement provided to hold the locking pin in the open position. This must be provided either in the coupler itself or on the uncoupling rod and its brackets. The M. C. B. Association recommended practice shows a coupler which is operated from the top and which has provision on the rod brackets for holding the lock up. There are some designs of couplers in which the lock is operated from the side or from beneath. With these of course a special design of

Fig. 122



REPUBLIC FRICTION DRAFT GEAR.

uncoupling rod has to be provided to suit the individual coupler.

Buffer Blocks and Deadwood (or Deadblock).—(Plate I, No. 57.) The deadwood (Buffer Blocks) is a piece of wood fastened to the end sill and usually arranged with a metal face to take the blow from the coupler horn when cars are coupled by impact. In addition to the deadwood, buffer blocks are sometimes used. These are metal blocks which are secured to the face of the deadwood, two to each end of the car, and which project out just far enough to take the entire blow

of impact, without interfering with the operation of the couplers. The Master Car Builders' Association has a recommended practice in this respect which is shown in Figure 115 in connection with the recommended method for attaching automatic couplers to cars.

CHAPTER VIII.

BRAKE RIGGING—FOUNDATION BRAKE—BRAKE SHOE—BRAKE BEAM—AIR BRAKE HOSE—AIR BRAKE HOSE TESTING APPARATUS—EFFECT OF AIR BRAKE ON CARS.

By Brake Rigging is meant the whole combination of detail parts, by means of which the movement of a car is retarded. For many years all train braking was done by manual power. That has now given place to automatic mechanical devices operated by compressed air which are used to the exclusion of other systems on all passenger equipment and are being used on all new freight cars and on a large majority of old ones.*

The "Safety Appliance Acts" of 1893 and 1903 provide that it shall be "unlawful for any common carrier engaged in interstate commerce by railway to use on its line any locomotive engine in moving interstate traffic not equipped with a power driving-wheel brake and appliances for operating the train-brake system or to run any train in such traffic * * * that has not sufficient number of cars in it so equipped with power or train brakes that the engineer on the locomotive drawing such train can control its speed without requiring brakemen to use the common hand brake for that purpose," and that

*The subject of the Air Brake as regards its construction and operation is fully treated in another volume of this series.

"whenever * * * any train is operated with power or train brakes, not less than fifty per centum of the cars in such train shall have their brakes used and operated by the engineer of the locomotive drawing such train; and all power-braked cars in such train which are associated together with said fifty per centum shall have their brakes so used and operated." Provision is made in the act that the Interstate Commerce Commission may from time to time increase the minimum percentage of power or train-brake cars to be used.

The foundation brake gear of a freight car adopted as standard by the Master Car Builders Association is shown in Figure 123.

The general arrangement and details of Air Brakes as shown on Figure 123 are standard.

Further standards of the Master Car Builders' Association in connection with this general arrangement are:

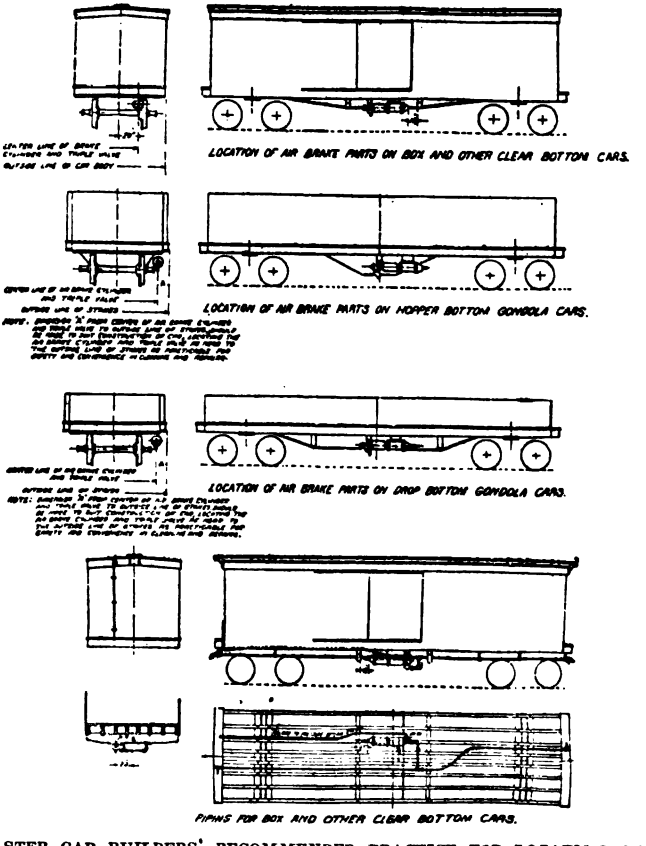
1. Maximum train-pipe pressure, 70 pounds per square inch.
2. Maximum brake power in freight cars, 70 per cent of the light weight of car.
3. All levers 1 inch in thickness; all pins to be 1-3/32 inches in diameter; all jaws or clevises made of ¾-inch by 2½-inch iron; all rods ¾ inch diameter.
4. Angle of brake beam lever, 40 degrees with vertical.

Malleable iron levers are being used a great deal instead of the wrought iron ones given in the Master Car Builders' standards. This same material is also met with as jaws for the brake rods or as dead lever guides.

In Figure 124 is shown the practice recommended by the Master Car Builders' Association for the location of air brake parts on various types of cars.

The essential features of the brake rigging, not parts of the foundation brake, are the Brake Shoe, Brake Beam and Hose with its couplings.

Fig. 124


LOCATION OF AIR BRAKE PARTS ON BOX AND OTHER CLEAR BOTTOM CARS.
LOCATION OF AIR BRAKE PARTS ON HOPPER BOTTOM GONDOLA CARS.
LOCATION OF AIR BRAKE PARTS ON DROP BOTTOM GONDOLA CARS.
PIPING FOR BOX AND OTHER CLEAR BOTTOM CARS.

MASTER CAR BUILDERS' RECOMMENDED PRACTICE FOR LOCATION OF AIR BRAKE PARTS ON CARS.

*The Brake Shoe.**—The standard Brake head and shoe adopted by the Master Car Builders' Association are shown in Figure 125.

The brake shoe is a piece of metal shaped to fit the tread of a car wheel, its purpose being to retard the revolution of the wheel through friction caused by its pressure with more or less force against the wheel. It is attached to the brake head or brake block by a key or some other form of fastening. It has been the subject of much investigation and experiment to ascertain the most suitable metal to be employed. Many patented shoes as to form and composition have been placed upon the market. The shoe must vary in composition for different kinds of service, thus one kind will be required for chilled wheels, another for steel tired driver wheels and another for steel tired coach wheels, and so on.

The following are the Master Car Builders' Standard Specifications for brake shoes:

For Cast-Iron Chilled Wheels.

Shoes when tested on the Master Car Builders' Association testing machine, in effecting stops from an initial speed of forty miles per hour, shall develop upon a cast-iron chilled wheel a mean coefficient of friction of not less than

22 per cent when the brake shoe pressure is 2,808 pounds.
20 per cent when the brake shoe pressure is 4,152 pounds.
16 per cent when the brake shoe pressure is 6,840 pounds.

For Steel-Tired Wheels.

Shoes, when tested on the Master Car Builders' Association testing machine, in effecting stops from an initial speed of sixty-five miles per hour, shall develop upon a steel-tired wheel a mean coefficient of friction of not less than

*This subject is also treated of in another volume of this series.

16 per cent when the brake shoe pressure is 2,808 pounds.
14 per cent when the brake shoe pressure is 4,152 pounds.
12 per cent when the brake shoe pressure is 6,840 pounds.

In connection with the brake shoe problem the following outline of its development is interesting.* Practically all these different styles of shoe are found in use at the present time.

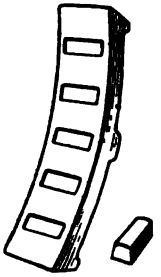
The Plain Cast Iron Shoe consists of a body of unchilled cast iron having a lug or connecting part formed with the body metal. This shoe has high frictional qualities, and has been largely used on all classes of railway equipment.

The Congdon Brake Shoe, with a body of unchilled cast iron and inserts of wrought iron in the wearing face to prolong the life of the shoe, was introduced in 1876, and

Fig. 126

PLAIN CAST IRON SHOE.

Fig. 127



CONGDON BRAKE SHOE.

marks the first step in the improvement of the ordinary cast iron shoe.

This construction produces a very durable shoe, extensively used on chilled wheels at the present day. It is not suitable for use on steel-tired wheels because of the liability of hard spots to form on the face of the insert and groove the tire.

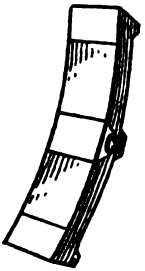
The Lappin Brake Shoe.—The difficulties attending the use of the preceding shoe on steel-tired wheels, brought forth in 1884 an improvement in cast iron shoes. This consists in chilling the body metal, forming alternate hard

*American Brake Shoe and Foundry Co.

and soft areas on the wearing face, producing a shoe of great durability which will not injure the steel tire.

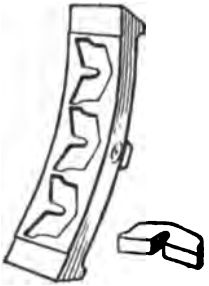
The Corning Brake Shoe.—Introduced in 1896 as an improvement on the preceding, consists of a body of hard iron, cast about an insert of soft iron located in the wear-

Fig. 128



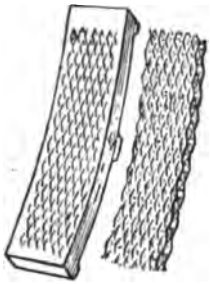
LAPPIN BRAKE SHOE.

Fig. 129



CORNING BRAKE SHOE.

Fig. 130



DIAMOND "S" BRAKE SHOE.

Fig. 131

STREETER BRAKE SHOE.

ing face. This construction guarantees a positive area of soft metal for frictional effect, durability being obtained by the chilling of the body metal against the insert and end chill blocks.

The Diamond "S" Brake Shoe.—In the effort to increase the wearing qualities or durability of the cast iron shoe,

the preceding designs were successful, but at some expense of friction or with bad effect on the wheel tread. In 1897 the Diamond "S" Shoe was introduced as one of high durability, secured at a minimum expense of retarding effect. This was obtained by casting the body metal about a bundle of expanded sheet steel, forming a composite structure of cast iron and soft steel. This, as the shoe wears down, presents a bearing face of unchilled iron interwoven with strands of steel which delay the rapid grinding of the cast iron, and produce high retardation without injury to the wheel tread.

The Streeter Brake Shoe.—In view of the fact that a shoe of hard iron when cast about an insert is structurally weak, the Streeter shoe was brought out in 1899 as an im-

Fig. 132

"U" BRAKE SHOE.

Fig. 133

HERRON REINFORCED SHOE.

provement on the past practice. It consists of a body of soft non-chilling iron surrounding a spiral insert of chilled iron extending the length of the wearing face of the shoe. This construction guarantees a positive relation of hard and soft metal producing a brake shoe of uniform qualities and great durability.

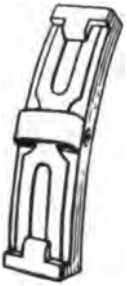
The "U" Brake Shoe.—The function of the brake shoe being primarily the generation of friction, the "U" type of shoe was introduced in 1900 as an improvement over the preceding face chilled shoes in which the hardened surfaces come in direct contact with the wheel tread.

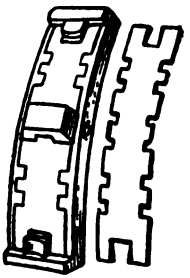
The "U" shoe consists of a body of hard iron having tapered ends projecting beyond the length of the ordinary shoe, the extensions being heavily chilled from the inclined

surface. This construction provides a brake shoe having unchilled or soft iron contact with the wheel equal in extent to the full face of the ordinary shoe. The hardest metal is in the extended ends, which, by their large expanse of smooth surface away from the wheel, radiate the heat from friction more rapidly and are not so liable to break on account of high heating as shoes provided with the face chill. This construction produces a shoe of maximum durability and frictional qualities.

The Herron Reinforced Shoe.—Shoes with hard body and inserts being structurally weak, are liable to be broken. The Herron improvement, introduced in 1890, is a means of strengthening the insert shoe. It consists of the application of one or more rods of wrought metal in the body of the shoe lengthwise just above the inserts. These rods

Fig. 134 **Fig. 135**





LAPPIN STEEL BACK SHOE. STREETER STEEL BACK SHOE.

serve to hold the parts of the body metal together and prevent fracture.

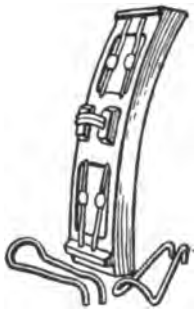
The Lappin Steel Back Reinforcement.—While the preceding invention materially strengthens the brake shoe, the location of the reinforcement within the body metal of the shoe, permits it to be destroyed before the shoe has been worn out. To accomplish the same results as regards strengthening the shoe and yet permit it to remain longer in service, the flat steel plate located at the back of the shoe was introduced in 1893. This consists of a plate of wrought metal having openings through which the body metal flows and anchors, located flush with the back of the shoe. This construction permits the shoe to be worn to the plate before removal.

The Diamond "S" Reinforcement, as shown in Figure

130, consists of a bundle of expanded sheet steel about which the body metal is cast. The steel strands extending to the back of the shoe serve as a bond and prevent fracture throughout the life of the cast iron.

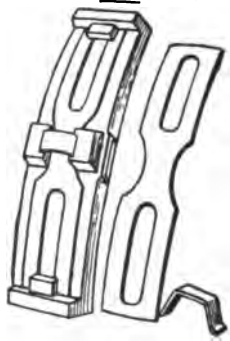
The Streeter Steel Back is similar to the Lappin back previously noted, and was introduced in 1900. It consists of a plate of mild steel imbedded in the back of the shoe, the body metal flowing up through dovetailed openings along the edge of the plate for anchorage. This steel back differs from the Lappin, and is an improvement thereon, in having two turned up projections which form reinforcing points to support the Christie lug, preventing failure of the lug when the shoe is worn to the plate.

Fig. 136



SAFETY WIRE BACK SHOE.

Fig. 137



IMPROVED STEEL BACK AND TUG SHOE.

The Safety Wire Back, introduced in 1902, provides a reinforcement to the cast iron body which extends to the attaching lug.

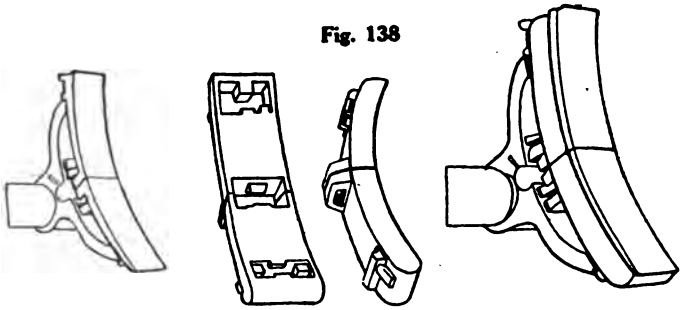
The ordinary cast iron lug is weak, and this defect is magnified when the body metal is of chilling iron, as the thin section at the top of the lug becomes very brittle. The Safety Wire Back forms the top of the lug with loops of wrought metal, entirely eliminating the possibility of breakage in the lug; at the same time the extended end of the wrought metal loops furnish admirable reinforcement for the main body of the shoe.

The Improved Steel Back and Steel Lug Shoe.—The steel back reinforcement previously mentioned consists of steel plates curved longitudinally to fit the shoe, but flat transversely. These plates being located flush with the back of

the shoe, afford insufficient anchorage and stiffness to the body metal, which when worn thin is liable to fall away from the plate.

The improved design of back, introduced in 1904, provides a plate arched transversely as well as longitudinally. The transverse curve permits the outer edges of the back to be slightly submerged in the body metal, and the process of curving opens the cut-outs along the center of the plate so as to form tapered openings into which the body metal flows and is securely anchored. This construction furnishes a stronger anchorage for the body metal and a stiffer support than is possible with the flat plates. This construction also embodies a wrought lug formed integral with the steel back, permitting the shoe to be worn to the limit of the cast iron body without the possibility of failure under any conditions of service.

Fig. 138



INTERLOCKING BRAKE SHOE.

The Interlocking Brake Shoe.—Another special form of shoe is illustrated in Fig. 138, which shows the "Interlocking" Brake shoe. The shoe itself is practically entirely worn out before any part of it is thrown away. The illustration shows how a partially worn shoe is inserted in the face of a new shoe, the old shoe then being used up before the new shoe touches the wheel.

The Brake Beam.—The standard Brake Beam outline of the Master Car Builders' Association is shown in the illustration, Figure 125.

The rules of the Master Car Builders' Association provide that:

"All beams must be capable of withstanding a load of 7,500 pounds at center without more than 1/16 inch deflection; where it is necessary to use a stronger beam, it must be capable of standing a load of 15,000 pounds at center without more than 1/16 inch deflection."

The question has been much discussed as to the relative merits of trussed wooden brake beams and of steel beams under freight cars. It is stated by the advocates of the trussed beam that the metal beam costs more; that it is costly to repair, and more likely, if it falls on the track, to derail trains, damage ties, roadbed, interlocking switches and floor construction of bridges. On the other hand, it is claimed for the metal beam that while it costs more it is stronger and more efficient; that disadvantage of form and detailed parts are fast being eliminated, and that the metal beam has come in the natural order of evolution and in response to a demand for strength in that member which beneath an eighty or one hundred thousand pounds capacity car must take care of a heavy force ranging from 6,000 to 7,500 pounds pressure applied with tremendous speed in emergency applications.

Of the various brake beams in general use the following illustrations will show the different distinct types. There is a natural tendency in this particular detail, to reduce the number of pieces of which it is composed, even, at times, at the expense of added weight. This is forcibly seen in the "Solid Brake Beam" and the "Sterlingworth Brake Beam," both of which are made up of commercial rolled bars, the former using an

I section and the latter a bulb iron or deck beam. The tendency to have the brake beams hung "inside" has a great deal to do with the making of

Fig. 139

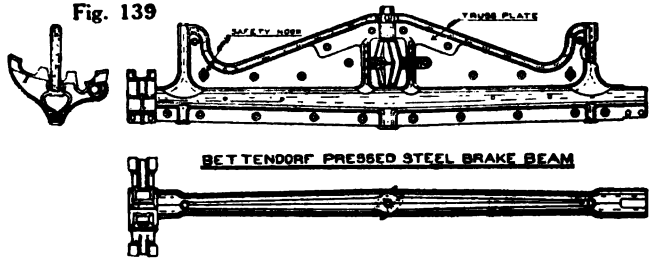


Fig. 140

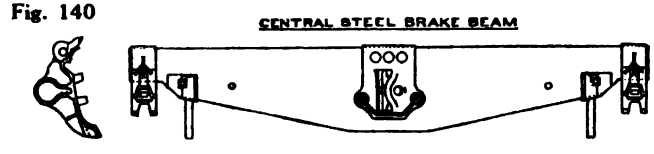


Fig. 141.

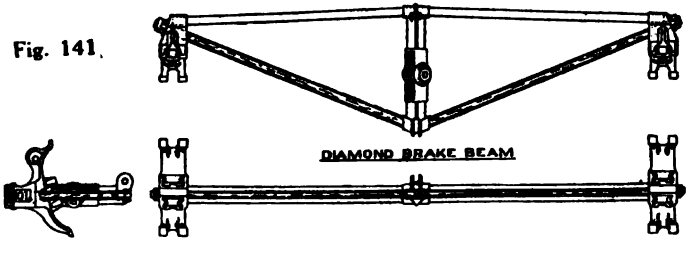
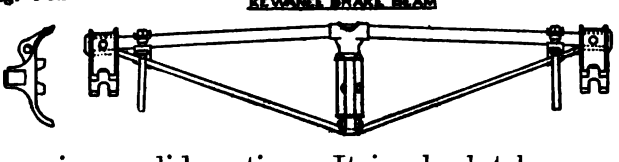


Fig. 142



beams in a solid section. It is absolutely necessary to have the beam clear the truck frame-work

and with this method of suspension it is readily seen by reference to Figure 148 that a trussed form of beam could not be used advantageously.

Still other forms of beams in common use are

Fig. 143

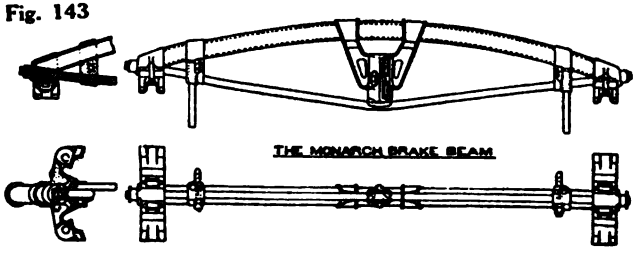


Fig. 144

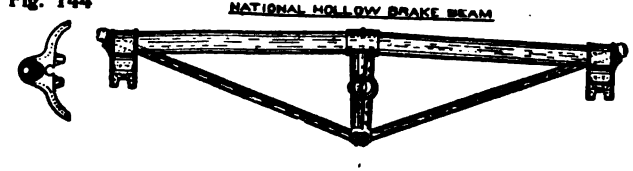
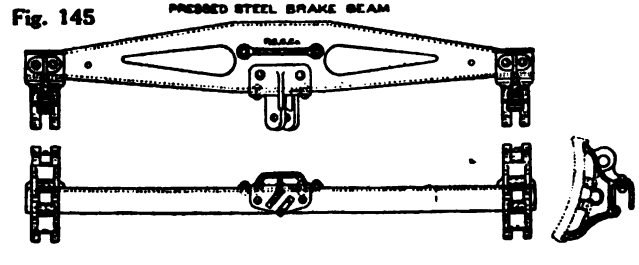


Fig. 145



the "Waycott," Figure 149; the "Damascus," Figure 150, and the "Vanderbilt," Figure 151.

Air Brake Hose.—(Plate 1, No. 207). These are flexible tubes made of Indian rubber and can-

vas located, one at each end of the car, and connected to the air piping. They are used to make a flexible connection between consecutive cars and

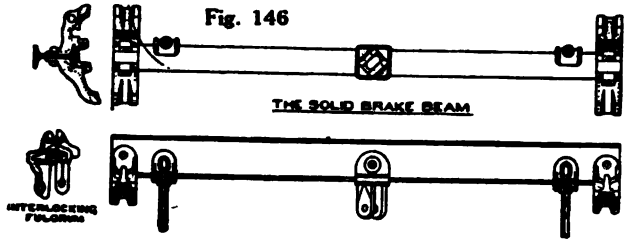


Fig. 146

Fig. 147

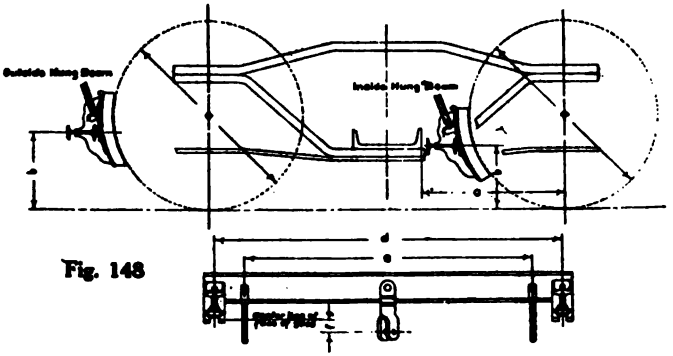


Fig. 148

SIMPLEX BRAKE BEAM.

thus allow the air which operates the brakes to pass through from one end of the train to the other, or so much of it as is coupled. A coupling (Plate

1, No. 206) is provided to connect the ends of the hose.

The following specifications have been adopted as standard by the Master Car Builders' Association:

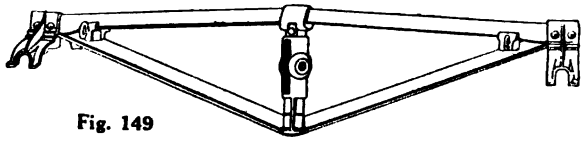
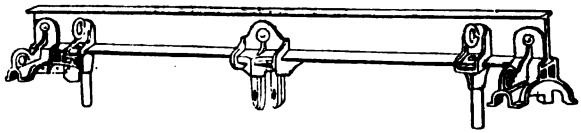


Fig. 149

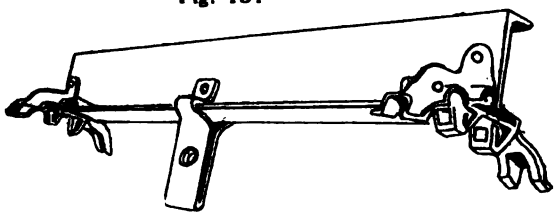
THE "WAYCOTT" FREIGHT BRAKE BEAM.

Fig. 150



THE DAMASCUS STANDARD BRAKE BEAM.

Fig. 151



VANDERBILT BRAKE BEAM.

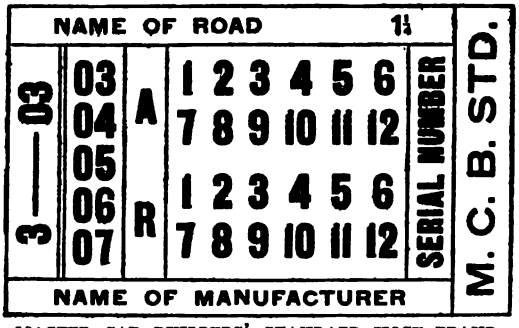
1. All air brake hose must be soft and pliable and not less than three ply nor more than four ply. These must be made of rubber and cotton fabric, each of the best of its kind made for the purpose; no rubber substitutes or short fiber cotton to be used.

2. Tubes must be hand made, composed of three calendars of 1/32-inch rubber. It must be free from holes and imperfections in general and must be so firmly united to the cotton fabric that it can not be separated without

breaking or splitting in two. The tube must be a high quality of rubber and must be of such composition as to successfully meet the requirements of the stretching test given below; the tube to be not less than 3/32 inch thick at any point.

3. The canvas or woven fabric used as wrapping for the hose to be made of long fibre cotton loosely woven, and to weigh not less than 22 ounces per yard, and to be from 38 inches to 40 inches wide. The wrapping must be frictioned on both sides and must have in addition a distinct coating or layer of gum between each ply of wrapping. The canvas wrapping to be applied on the bias.

Fig. 152



MASTER CAR BUILDERS' STANDARD HOSE BRAND.

4. The cover must be of the same quality of gum as the tube and must not be less than 1/16 inch to ⅛ inch.

5. Air Brake hose to be furnished in 22-inch lengths. Variations exceeding ¼ inch in length will not be permitted. Hose must be capped on ends with not less than 1/16 inch or more than ⅛ inch rubber caps. Caps must be vulcanized on, not pasted or cemented.

6. The inside diameter of all 1¼-inch air brake hose must not be less than 1¼ inches or more than 1 5/16 inches, except at the ends, which are to be enlarged 3/16 inch for a distance of 2¾ inches, the change from the smaller to the larger to be made tapering.

The outside diameters must be kept within the following dimensions:

The main part of hose 1⅞ inches to 2 inches.
The enlarged ends 2 1/16 inches to 2 3/16 inches.

The hose must be finished smooth and regular in size throughout as stated above.

7. Each standard length of hose must be branded with the name of the manufacturer, year and month when made, and serial number, the initials of the railway company, and also have a table of raised letters at least 3/16 inch high to show the date of application and removal, thus:

Each lot of 200 or less hose must bear the manufacturers' serial number, commencing at 1 on the first of the year and continuing consecutively until the end of the year.

For each lot of 200 or less one extra hose must be furnished free of cost for test.

All markings to be full and distinct and made on a thin layer of white or red rubber, vulcanized, and so applied as to be removed either by cutting with a knife or sharp instrument.

8. Test hose will be subjected to the following test:

Bursting Test.

Test hose must stand for ten minutes a pressure of 500 pounds before bursting. Each hose must stand a shop test of 200 pounds.

Friction Test.

A section 1 inch long will be taken from any part of the hose and the friction determined by the force and the time required to unwind the hose, the force to be applied at right angles to line of separation. With a weight of 25 pounds suspended from the separated end, the separation must be uniform and regular, and when unwinding, the average speed must not exceed 6 inches in ten minutes.

Stretching Test.

A 1-inch section of the rubber tube or inner lining will be cut out at the lapped or thickest part. Marks 2 inches apart will be placed on the test piece; it will then be stretched until the marks are 10 inches apart, and released immediately. The piece will then be re-marked as at first and stretched 10 inches, or 400 per cent, and will remain stretched ten minutes. It will then be released and the distance measured between the marks ten minutes after the release. In no case must test piece show defective rubber or show a permanent set of more than ¼ inch between the 2-inch marks.

Small strips taken from the cover or friction will be subjected to the same tests.

9. If the test hose fails to meet the required tests, the lot from which they are taken may be rejected without further examination. If the test hose is satisfactory the entire lot will be examined and those complying with the require-

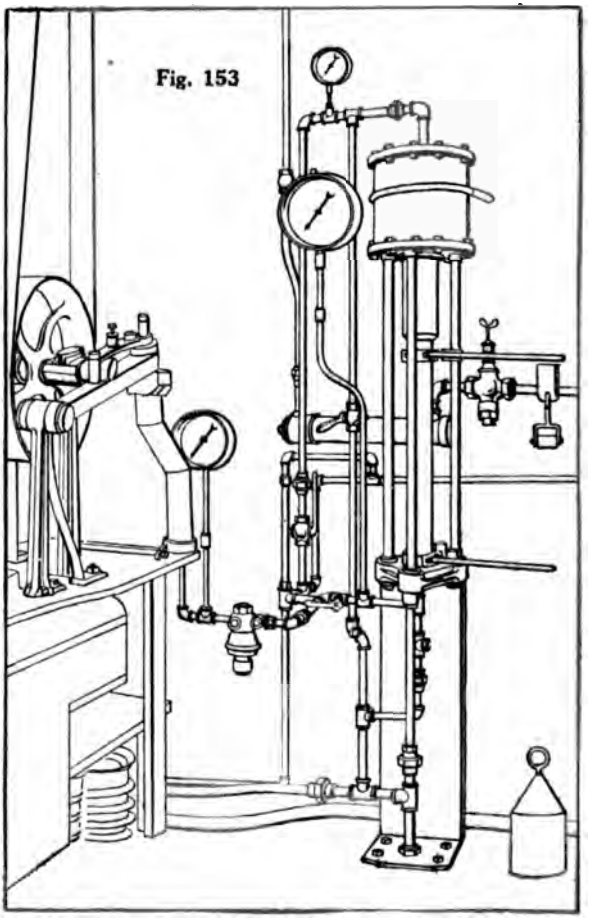
ments herein set forth will be accepted. All rejected hose will be returned to manufacturers, they paying freight charges both ways.

Air Brake Hose Testing Apparatus.—In order that Air Brake Hose may be thoroughly proved before being placed in service special devices are used by some railway companies to make their required tests. One such apparatus used by a large railway system is described as follows*:

The device for the bursting test is shown to the right of Figure 153 and the apparatus for the buckling test to the left of the same figure. Another view of the buckling test machine is shown by Figure 154. The latter machine reproduces, as far as possible, the vibration or buckling to which hose is subjected when in service. It is operated by a pulley driven by a belt from a counter shaft above. On the shaft of this pulley is a crank for giving motion to a vibrating arm. The illustrations show the manner in which the hose is attached at one end to a point on the table connected with the air supply pipe, and on the other end to a vibrating arm. In order to save time in placing and removing the hose, unions are so arranged that the hose may be held securely by a lever clamp. A constant pressure of air is maintained in the hose by using a standard Westinghouse signal line reducing valve. The best results are obtained by fifteen pounds pressure. In the union between the reducing valve and the hose is a copper diaphragm in which is located a small hole of about one one-hundredth of an inch in diameter. This is provided to reduce the flow of air into the hose so that when the hose is suffi-

*Norfolk & Western Ry.

ciently worn by the buckling action to allow the escape of air it cannot be supplied fast enough to maintain pressure therein. In order to announce



HOSE TESTING APPARATUS.

a break and consequent leak in the hose, a whistle is attached to the end of the vibrating arm, as shown in the illustrations, and connected to the upper end of the hose. Air is maintained in the hose and kept from leaking through to the whistle

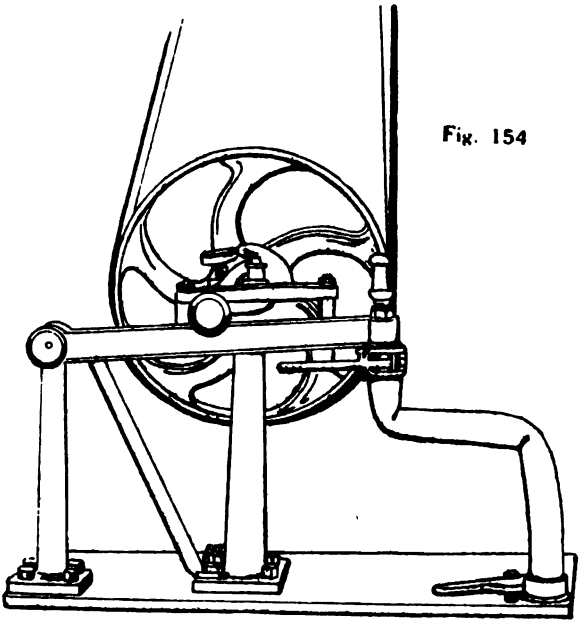


FIG. 154

HOSE TESTING APPARATUS

by a plain bevel seat valve, which is held closed by pressure of the air. On the opposite side is a spring to unseat the valve, which is set at 12 pounds. When a leak occurs in the hose and the pressure is reduced below 12 pounds, the valve unseats, permitting air to pass to the whistle

announcing the leak. An ordinary cyclometer is arranged on the frame supporting the machine and is operated by the crank engaging the lugs thereon, so that the number of vibrations are counted automatically. The hose is usually given about 120 vibrations per minute and should stand about 75,000 vibrations, or bucklings, before failing.

The apparatus for the bursting test consists of a frame for supporting the hose and pipe connections and a differential piston for supplying the necessary pressure. The position of the hose is shown in the illustration and the manner in which it is clamped is also indicated. In making the test water is admitted from below to fill the hose and small cylinder. The valve is then closed and air admitted to the top of the upper and larger cylinder, forcing the piston down and supplying a pressure to the hose. The diameter of the smaller piston in this instance is 2¾ inches and the larger, or air cylinder, is 8 inches in diameter.

The air hose however is one of the few parts of a car equipment that can hardly be satisfactorily tested before application with a view to finding out its possible life and durability. After all is said and done the final results are only obtainable from actual service condition and this is the most reliable data to follow.

CHAPTER IX.

THE USE OF STEEL IN THE FRAMING OF CARS.

In the course of the evolution of the freight car we seem to have arrived at a period when it is generally accepted that a substitute for wood must be found either in whole or in part. Already the detail members of the truck are made of metal which has practically supplanted timber for all new cars.

The use of steel in cars is ably presented in the following paper:*

"This is a subject which is being considered more or less by the managements of railroads generally. The eastern roads, and particularly the coal and ore carriers, have purchased large numbers of steel hoppers and gondolas. The development of most of these was a direct change of material from wood to steel instead of the general introduction of steel parts.

"This was brought about largely by commercial enterprise and not a gradual evolution, as has generally been the case with other railway equipment. One important coal carrying road has adapted the composite construction, employing steel for the frame members which carry the load and wood for the body which merely retains or holds the lading. So far as trucks are concerned very little if any wood is now found in any late designs, particularly of the larger capacities.

"On western roads the steel cars are not so numerous. A few roads have something, coal cars mainly, although quite a number of steel underframe box cars have been put into service. The writer recently examined a wreck in which 16 box cars were derailed, a number of which had steel underframes. The ease of handling and the greater

*Read before the Western Ry. Club, March, 1904, by C. A. Seley.

salvage of these cars was very noticeable as compared with the wooden cars. Steel has been used, although not altogether successfully, in combination with wood in underframing.

"Steel center sills in an otherwise wooden frame are liable to an excessive load as it is impossible to make the wooden sills work within the range of deflection allowable in the steel sills.

"A great improvement is noticeable in the bolsters of wooden cars in which metal either in the solid or a built-up construction is now used to the total exclusion of wood.

"There is still a very weak spot, or, rather, two of them in our box car designs, and those are the ends. Heavy switching shocks and the heavier trains and engines in road service have brought about a considerable increase of mortality in that respect in both old and new cars and no wood construction is adequate to prevent this trouble.

"If ever there was a place for steel it is the framing of box car ends. One prominent eastern road is using structural steel in the sides of box cars, not as members of the framing, but to prevent bulging of the wooden side framing. The time is rapidly approaching, if it is not here already, when we should consider steel for the entire framing of box cars.

"Long, heavy timber for sills is getting expensive and oak for framing has well nigh disappeared. There is a real need for stronger cars to withstand the strenuous movement of modern transportation. The box car, being the principal type of car used in our middle western traffic, is the one to which attention should be paid and so designed that steel shall take its place for all of the carrying members.

"The ideal box car will have a complete steel frame up to and including the side and end plates and probably the carlines. Such a car need be no heavier than present weight for same capacity, strong ends can be provided; that part of the load coming to the sides can be carried by the upper framing, bulging need not be taken care of by special provisions, and the general cost of maintenance of such a car will be a fraction of that required for the keeping up of old style cars.

* * * *

"It has been laid down as a principle, and perhaps properly, that the carrying strength should be provided in the underframing of wooden box and other cars having a superstructure.

"The upper framing, therefore, is light and contributes little in carrying the load. Shrinkage and the working of

the body loosens the structure generally and tightening of rods and renailing of siding are considerable items in the expense of maintenance.

"It has been conclusively proved that by the use of steel in hoppers, gondolas and box cars the side framing will successfully carry that portion of the load coming to the sides. In a wooden framed car the braces are compression members and if properly applied give the cars its initial camber without the assistance of the truss rods. The posts are not the tension members, as they are not attached to sills or plates. The side framing rods are the tension members, but are generally inadequate both in size and bearing to take their lading if required to carry much of a load.

"In a steel frame for a box car both posts and braces are riveted to sills and plates and while the braces do not contribute lateral strength, the posts do, both by their inherent strength due to their section and also by the bowstring action, if it may be so termed. As their load is increased this action comes more and more into play, stiffening the posts and preventing bulging.

"It might be better to use the Z-bar section, and this has been done in later designs.

"The end framing when of steel can be thoroughly tied, using angles for corners and I-beams for end intermediate posts, and the possibilities in strengthening these notoriously weak parts of the framing are immense.

"With the side framing members securely riveted, it will be seen that there can be no fore and aft working of the body to loosen the nailing of the sheathing and an important gain in maintenance results.

"With the shallow side sills used in such construction, inspection is greatly facilitated.

"Some years ago a lot of hopper cars were built with 15-inch channel side sills. Later another lot of a different design with 8-inch sills were built to the strongly marked approval of the car inspectors. Easy inspection means better inspection and when made difficult by covering the parts which should be easily accessible, defects will be missed. The steel underframe, while it has very good points, has this unfavorable feature. A difficult point in the design of steel frame box cars is to provide stable nailing foundation for the sheathing and lining without contributing materially to the weight and cost in building. This is not an insuperable difficulty, however, as has been demonstrated.

"There is a medium ground where weight, strength and low cost of maintenance will meet. While excessive light weight of car means a high percentage of possible revenue

load it also means high cost of maintenance, as no structure subject to shock can be whittled down without increasing the liability to earlier failure and an increased repair account. It is possible to design a steel frame box car of lighter weight than a well designed wooden car of like capacity. It should cost little if any more and the difference between the two in the longer life and decreased cost of maintenance, if capitalized, will warrant the increased cost and help pay a dividend besides.

"There has been some discussion of late regarding the use of steel in passenger equipment. One road has done some interesting pioneering in this line, but it is probable that progress will be slow in the development of this use of steel. It will come, however, just as surely as steel has taken the place of wood in bridges, tender frames and freight car framing.

"We are using steel extensively for platforms now and for plating sills and its further introduction into the framing may be slow, but it will be sure. The very long timber required for passenger car sills is expensive and steel sills can be obtained full length if desired, although this is not necessary owing to the readiness of splicing. It may take some experimenting to make a steel frame that will be satisfactory in regard to necessary stiffness, yet not be so rigid as to unpleasantly affect the riding qualities.

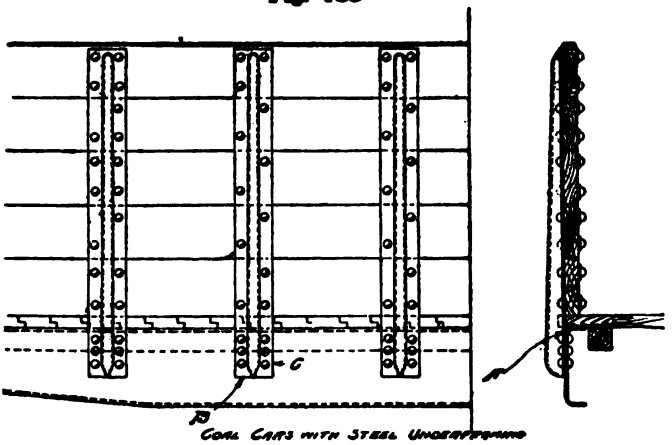
"Baggage, postal and combination cars having unsymmetrical, broken side framing would require steel underframing, under trussed, and four sills are sufficient with riveted-in cross ties or beams to support intermediate nailing strips. Other cars having an unbroken side framing might have a steel truss in the sides well bracketed to the center sills and with heavy body bolsters such a construction could be made as to avoid under trussing.

"Designing the steel frame will not be as difficult as arranging for the attachment of the wood construction necessary in the structure. The corner and door posts and end framing can be sufficiently of steel to minimize danger of telescoping if not prevent it entirely."

The illustrations Figures 155 and 156 exemplify some of the methods of steel underframing applied to coal and box or stock cars.

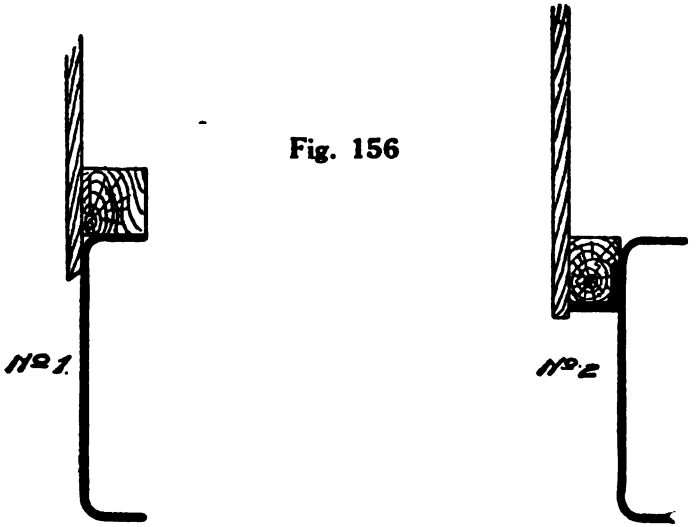
The *bete noir* of the composite coal car is rust. "The wooden floor and sides become steeped with moisture from the coal which keeps the iron work of the car moist with water containing sulphur

Fig. 155



COAL CARS WITH STEEL UNDERFRAMING

Fig. 156



BOX OR STOCK CARS WITH STEEL UNDERFRAMING.

and other injurious elements. The drippings follow the interior and exterior of the siding, run from the ends of the decking down over the side sill at *A* (Figure 155) badly corroding at the corner of the top flange of the sill and the entire distance of the side. At *B* and *C* (Figure 155) the moisture follows down between the boards and the post, eating away the rivets and under side of the post. The underframing of the composite cars is protected with tar paper, but with the constant dripping taking place, especially in wet weather in coal cars the tar paper does not seem to protect the side sills."*

The steel underframing to box cars has been found very satisfactory. "With proper steel underframing and truck, with suitable design of draft rigging, running repairs to freight equipment will be lessened to a minimum and the danger to equipment and lading in case of wrecks has been greatly reduced. Attention should be paid to the design especially at the side sills to avoid the corroding on account of water dripping from the sides of the car on to the side sill which has proven so serious in the case of composite cars. Figure 156 shows two designs No. 1 and No. 2. No. 1 has proven dangerous in this respect inasmuch as it permits the water to drain on to the side sill, badly corroding and making painting necessary. No. 2 shows the design more generally adopted and one that has proven much stronger and has done away with the possibility of corrosion by reason of the water dripping as in the case with No. 1. Care should be exercised to see that the siding extends below the angle riveted on

*A. L. Humphrey.

to the side sill on which rests the nailing sill. With this design trouble from corroding will be entirely obviated.*

There is nothing connected with railroads, it may be said, that is being watched with more interest or that is receiving more attention on the part of those interested than the steel car. Its advocates claim for it the most distinct advantages. They argue that the repairs required are phenomenally low and that when railways have become habituated to their use and are provided with proper facilities such repairs as are needed can be made with as much facility as are those of wooden cars; they further say that the use of steel results in a reduction of the dead weight of the vehicle in proportion to the load hauled, a most important economic factor in the handling of freight and that in case of wrecks and the manipulation of long and heavily loaded trains the steel car resists more effectually the shocks and strains incident to the service: finally it is claimed that when the steel car is worn out everything about it has a market value as scrap, which is not the case with wooden cars.

As in the case of the composite car rust is the formidable foe of the steel car. If it were vanquished the steel car body would be everlasting, but as yet no successful preventive means for protecting the interior of cars designed to carry such freight as coal has been found as the coal dropping into the car scales the paint, and sulphur and other chemicals in the coal attack the unprotected surface of the metal. Rust can be guarded against by "cleaning the metal properly in the

*A. L. Humphrey.

first place and cementing all points with good red lead or other paint that will adhere to the material. The surface of the plates must be thoroughly cleaned of rust and greased before being painted: the paint must be of good quality free from drying compounds. Each coat of paint applied must be allowed to thoroughly dry before applying the next. Whenever a bare spot develops it should be touched up promptly. Should paint fail and it be desired to clean it off, sand blasting is the only rapid method of doing the work."*

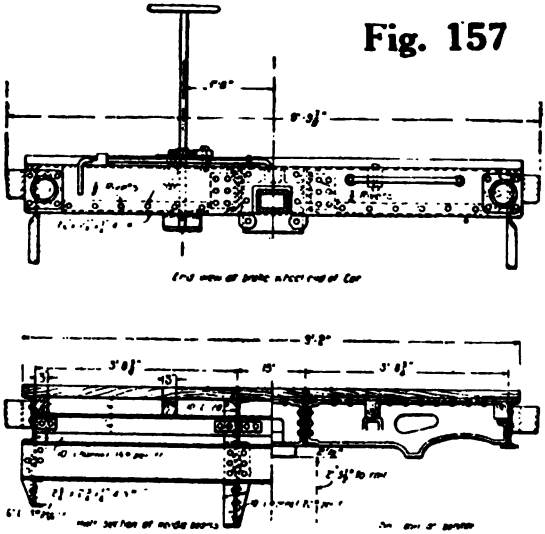
The steel car of the future has doubtless yet to be designed. No one doubts but that it will come in due time in the evolution of the freight car, because the wooden car cannot in all cases even now fully meet the requirements of the heavy service.

The illustrations Figures 157 and 158 show the design of a 100,000-lbs. capacity flat car known as the Vanderbilt Steel Flat Car. It was patented by Mr. Cornelius Vanderbilt. The entire frame is of structural steel and the flooring is of wood. The most interesting feature of this construction is the design of sills. The use of an unusually light sill is made possible by a form of truss of structural steel instead of using the usual truss rod, thus producing a sill which is much lighter than an entire channel section or the deep fish belly. The center sill is a 10-inch channel weighing 20 lbs. per foot, 35 ft. 5¼ ins. long, trussed by a 10 in. channel weighing 20 lbs. per foot bent as shown in the elevation of the car and riveted at the ends with the web of the truss

*William McIntosh.

against the web of the sill and the lower flanges flush. The side sill is of similar construction composed of a 10 in. channel weighing 15 lbs. per foot and trussed by a 6 in. channel weighing 13 lbs. per foot. On account of the absence of metal along the neutral axis the construction of each sill is unusually light and the sill proper constitutes a compression member while the truss constitutes

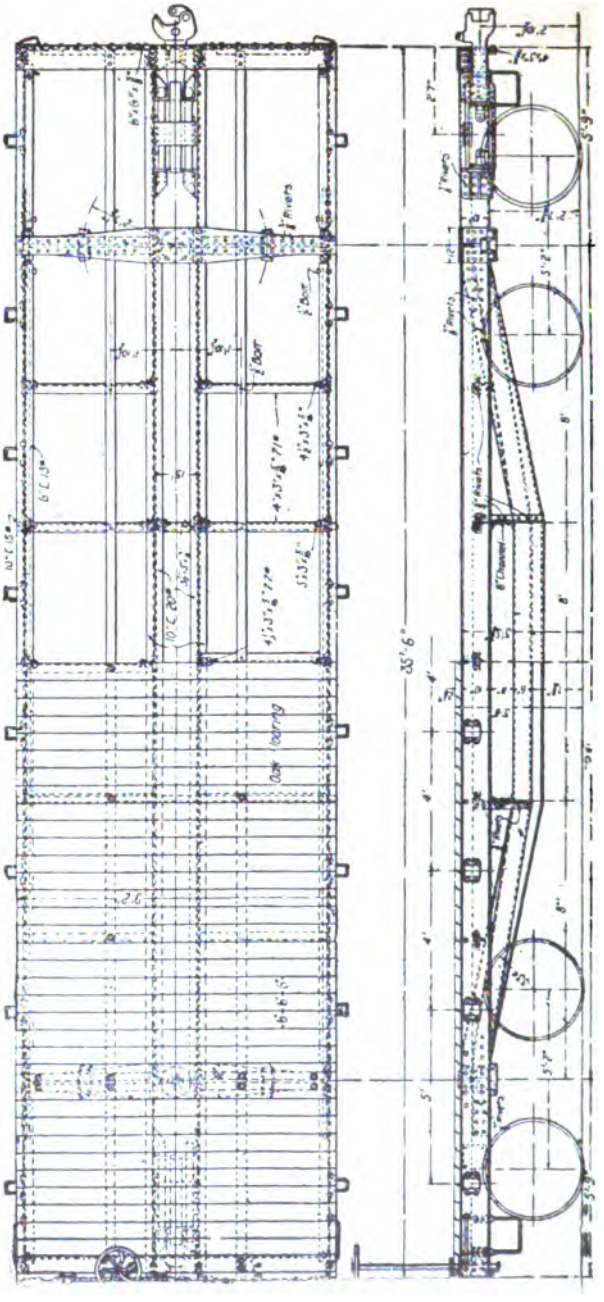
Fig. 157



VANDERBILT 100,000 LBS. CAPACITY STEEL FLAT CAR. (SECTIONAL VIEWS.)

the tension member of the entire structure. Between the upper and lower members, two 8 in. channels are disposed as needle beams which are firmly secured to both by heavy angle plates thus strengthening the car laterally. Cross braces of angle iron are disposed at intervals between the

Fig. 158



VANDERBILT 100,000 LBS. CAPACITY STEEL FLAT CAR. PLAN AND SIDE ELEVATION.

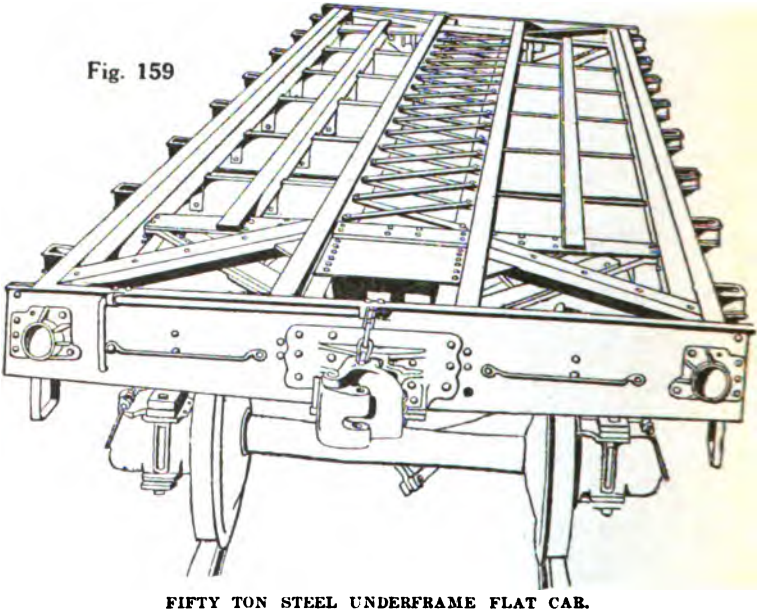
center and side sills and these constitute floor beams to which the nailing strips are secured. The sills are supported at each truck by a bolster of cast steel arranged in three sections between the sills, as indicated by the sectional view of the car showing the bolster. The structure at this point is strengthened by a steel plate 12 by ¾ ins. secured with ⅞ in. rivets to the upper flanges of the sills and bolster castings. Each end sill is a ⅜ in. steel plate bent to *L* shape, cut away at the center to accommodate the coupler and stiffened by angle irons riveted at the bottom. The car is 35 ft. 6 ins. long over end sills, 9 ft. 2½ ins. wide over side sills, 24 ft. between truck centers, with a light weight of 28,650 lbs. The height from top of rail to top of floor is 3 ft. 8 ins., and height to top of brake shaft 6 ft. 6 ins. The capacity of the car is 100,000 lbs. distributed between bolsters or a concentrated load of 55,000 lbs. between the needle beams.

*Fifty Ton Steel Underframe Flat Car.**—(Fig. 159) In this car the underframe is trussed with three 2-in. rods instead of two as in the box cars, the third rod being placed under the center line of the car. The attachment to the top plate of the bolster is the same as that used in box cars. This car is 9 ft. 5 in. wide over floor and 9 ft. 1½ in. over side sills, and in order to utilize the same forming tools for the bolsters as were used in box cars cast-iron filler blocks 3⅝ in. thick were riveted inside the side sills and the bolster plates were riveted on to them. The needle beams are 10-in. 25-lb. *I*-beam riveted under the sills to

*Middletown Car Works.

brackets and inclined away from the vertical sufficiently to take the upward thrust of the truss rods in line with the web. Plates cut to the shape of a keystone are riveted on the outside of the side sills over the ends of the needle beams to further stiffen them. The light weight is 37,840 lbs.

Fig. 159

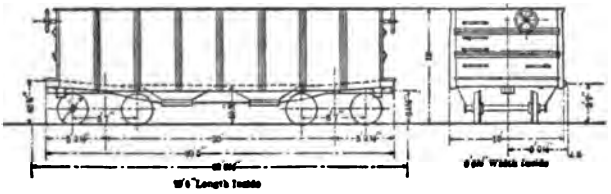


FIFTY TON STEEL UNDERFRAME FLAT CAR.

Truss rods under steel frame cars are being introduced although they have not up to a recent date been used very extensively, in this country at least, probably because they are not altogether satisfactory under wooden cars. It is essential, of course, to have a stiff backbone to an underframe to transmit the stresses from end to end

of the car in buffing, but it is not necessary to design the center sills as longitudinal columns to resist compression and as simple beams to carry all of the load as well. The combined stresses are impossible of calculation with any accuracy and oftentimes much heavier members are put into the frame than needed. A properly secured and tightly drawn truss rod or truss rods assists materially in carrying the load and permits the use of a lighter section for the same strength or greater stiffness and strength for the same section, under a given load. In England and on the Continent truss rods are used on nearly all steel underframe cars. If the sills are formed in the shape of a fish-bellied girder or other section of uniform strength, truss rods are of little or no value, but there seems to be no reason why rational principles of truss design should not be applied to steel car frames as well as roofs and bridges when the members of the frame are of standard rolled sections.

Fig. 160



STEEL GONDOLA CAR.

Figure 160 shows a steel Gondola Car with two small hoppers designed and built in 1898.* Its cubical capacity was 2,038 cubic feet heaped—its

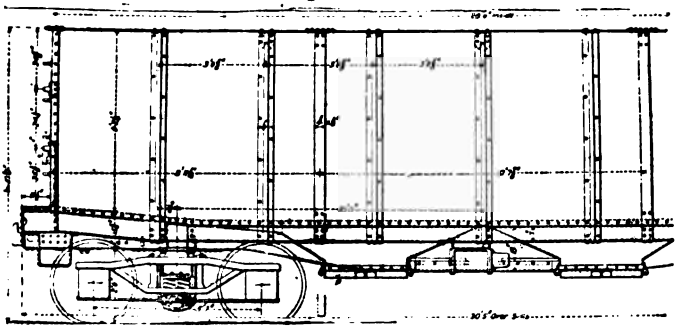
*By the Pennsylvania Railroad.

weight was 33,800 lbs. and capacity 100,000 lbs. This was the first steel car used on the Pennsylvania Railroad with satisfactory results. It had no side sills, the sides being employed as trusses to assist in carrying the load.

This is an interesting car from a structural point of view because it was the first steel car built for one of the largest railroad systems. It weighed less than any 50 ton car that had been built. As a backbone this car has a box girder 14 ins. wide open at the bottom and built of two pressed steel channels with the flanges facing each other. At the center of the car this girder has a depth of 18 ins. At the hopper doors it begins to taper in a curve toward the bolsters where the depth for a straight portion 23 ins. long is 10 ins. At the body bolsters the center sills are interrupted, the bolsters being continuous across the car. The bolster is an inverted pressed steel trough, continuous across the car. Below the bolster is a large cross shaped bottom cover plate taking in the bottom flanges of the bolster and center sills, extending along the bolster to form the upper side bearings and reaching toward the end of the car to secure the short draft sills. Toward the center of the car this cover plate extends under the center sills to a point 18 inches from the center of the bolster. From the bolsters to the ends of the car the center sills are continued by short sections of pressed plate construction with a sloping top to suit the slant of the floor at the ends of the car. Within these is the draft gear. The sides of the car are 7 ft. 2½ ins. high of ¼ in. plate, stiffened by pressed steel posts riveted to the plate, making panels 3

ft. 6⅝ ins. long. At the top of the sides and ends the side plates have an outward flange of 3¼ ins. to serve as a top chord. Three pressed steel struts of inverted *V* section tie the side across the car at the top. The floor rests directly on the sills. The end sill is a ⅜ in. plate of pressed steel, giving a platform 11 ins. wide at each end of the car. The illustrations Figures 161 and

Fig. 161



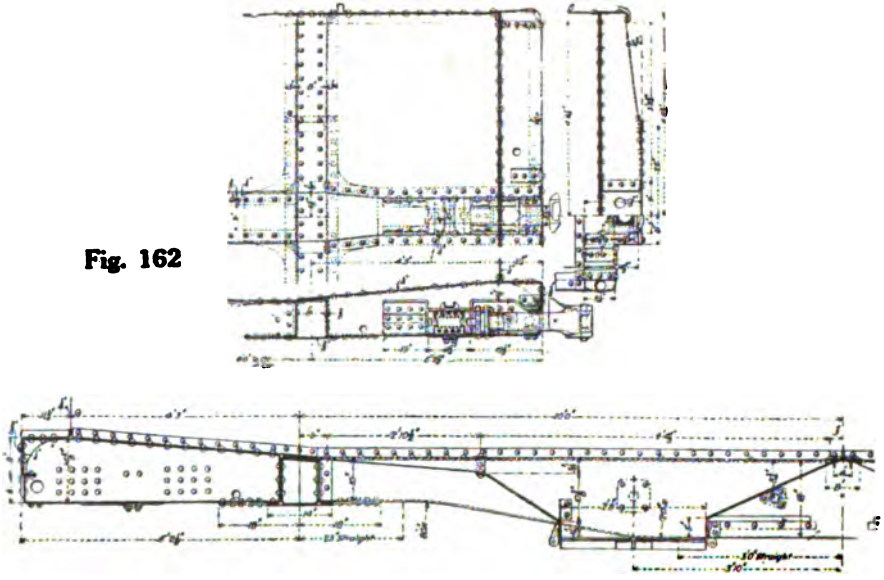
STEEL CAR.

162 will more fully show the construction of this car.

Figure 163 is a steel self clearing hopper of 100,000 lbs. capacity constructed and put in service* in 1898. It is a self clearing hopper of 100,000 lbs. capacity and self dumping. Its dead weight is 36.36 per cent of the paying load as compared with 45.7 per cent in the wooden hopper car which it replaced.

*The Pennsylvania Railroad.

Fig. 162

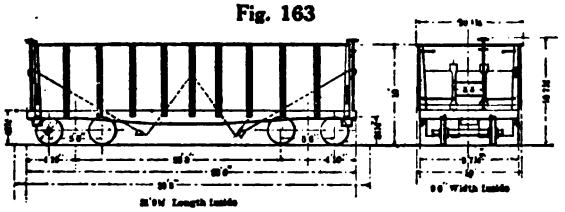


STEEL CAR—CENTER SILL, END SILL, BOLSTER AND DRAFT GEAR CONSTRUCTION.

Another steel coal car* is shown in illustrations Figures 164, 165, 166, which give the general construction and details clearly enough not to need any extensive explanation.

The weight of this car is 39,150 lbs. and its cubical capacity 1,897 cubic ft. heaped. The ratio of dead to paying load is therefore 36.4 per cent. The backbone is a pair of fish-bellied pressed steel channels 17 in. deep at the center and 10 in. deep at the ends. They are continuous through the length of the car 33 ft. and the bolsters are

Fig. 163



STEEL SELF-CLEARING HOPPER.

riveted to them. These sills receive the draft gear and are spread 12⅞ in. apart to receive Westinghouse friction gear. The side sills are continuous and of the same form and size as the center sills, except that the side sills are ¼ in. plate, while the center sills are ⅜ in. thick. In both cases the flanges of the channels are 3⅞ in. wide. It will be noted that this construction does not utilize the sides of the car as trusses in carrying the load with the idea of obviating the necessity for heavy side sills. The end sills are trough-shaped pressed plates.

*Pennsylvania Railroad.

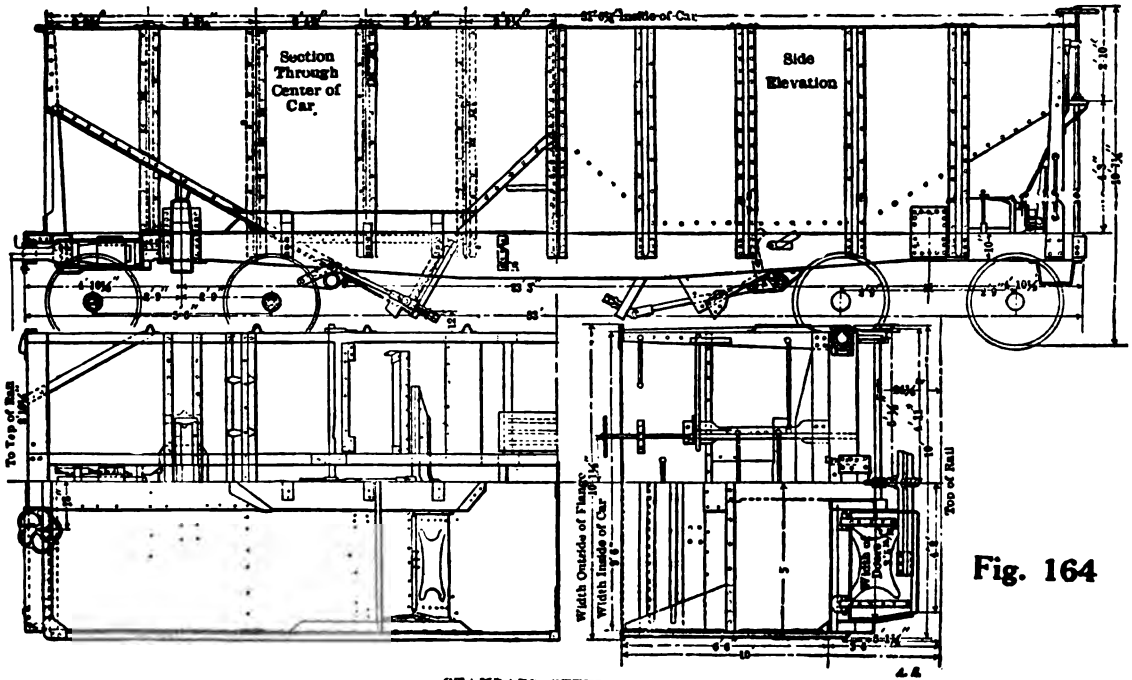


Fig. 164

STANDARD STEEL COAL CAR.

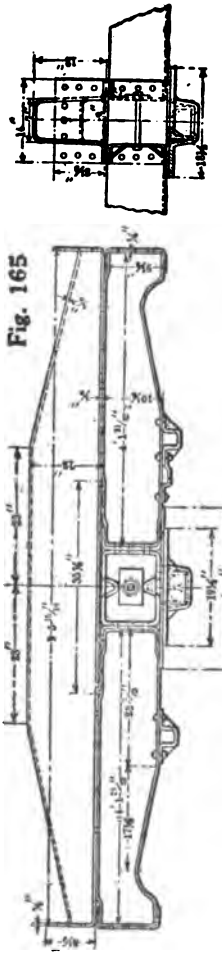


Fig. 165

BODY BOLSTER CONSTRUCTION, STANDARD STEEL COAL CAR.

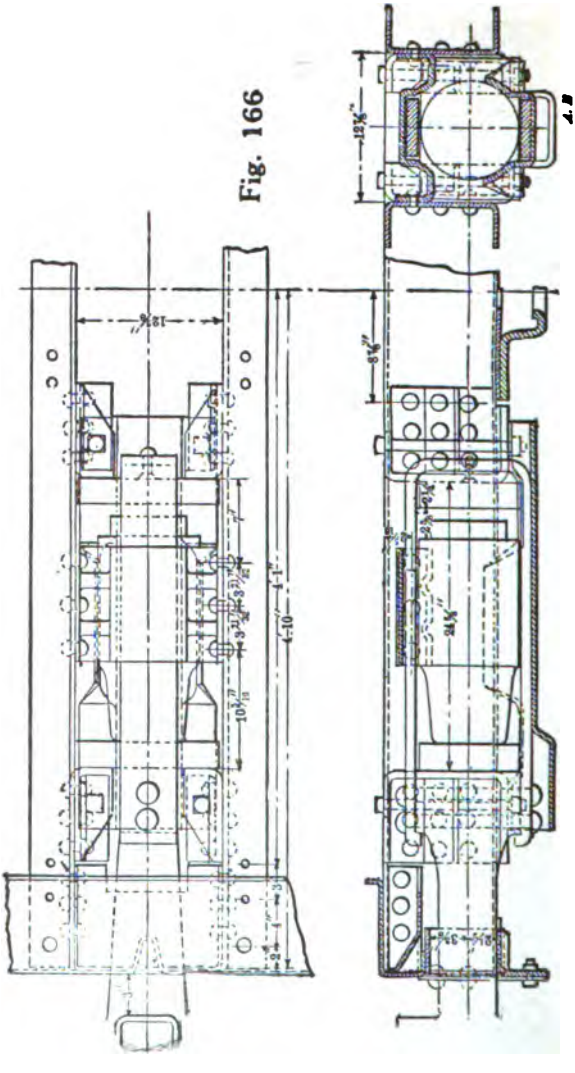


Fig. 166

DETAILS OF DRAFT GEAR ATTACHMENT. STANDARD STEEL COAL CAR.

*A Thirty Ton, Narrow Gauge, Steel Hopper Car** is illustrated in Fig. 167. This is an all steel hopper car with floor slope of 45°, designed to handle copper ores and concentrates. Track gauge 3′; car capacity 60,000 lbs.; light weight 18,000 lbs.; length inside 17′ 6″; width inside 6′ 3″; height from rail to top of body 7′ 10″.

The frame is a special patented construction designed to secure great strength and rigidity with a minimum amount of material. As shown by the illustration, all superfluous sheet metal in the body has been eliminated. The body is supported at the transoms by the double inclined posts attached to the side sills and sides of the box. Additional inclined truss members are used to further secure the sills to the superstructure. To prevent bulging of the lower portion of the hoppers, at the level of the sills, two horizontal lattice girders are used, extending from transom to transom and riveted to the lower flanges of the side sills and further secured to the sides of the hoppers. The body bolster is of the built *up* structural type continuous across the car from side sill to side sill. ¼″ plates are used for the sides and bottom of the body; side sills are 7″ channels 9.75 lbs. per foot, with end sills of the same section. The doors are operated by the King mechanism which is entirely outside the load contained in the car and opens both doors by a partial revolution of an operating shaft accessible from one end. For this car it is claimed that when loaded with 66,000 lbs. of material almost 80% of the total weight hauled by

*Built by the Middletown Car Works.

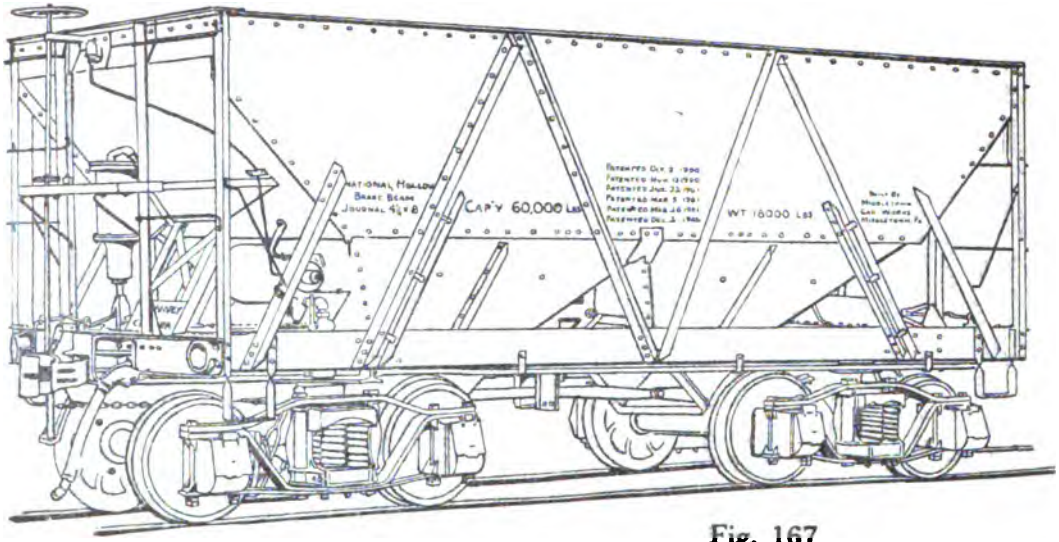


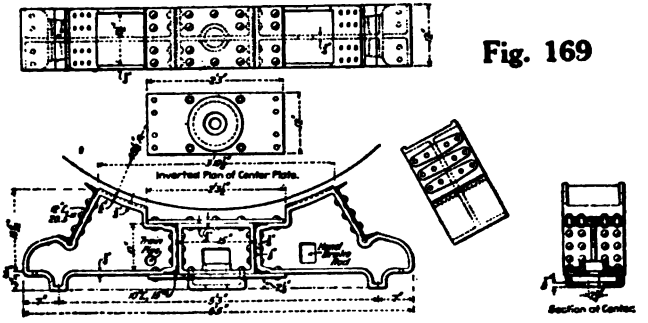
Fig. 167

30-TON STEEL HOPPER CAR.

the locomotive is paying load, and only 20% is dead weight.

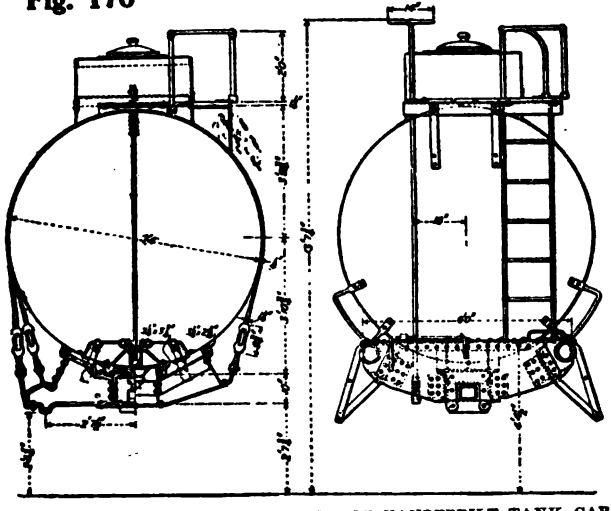
*The Vanderbilt Steel Frame Tank Car** is illustrated in Figs. 168, 169, 170. This car has a

Fig. 169



DETAILS OF CAST STEEL BODY BOLSTER. VANDERBILT TANK CAR.

Fig. 170



CROSS-SECTION AND END ELEVATION OF VANDERBILT TANK CAR.

*Built by the Middletown Car Works.

capacity of 10,000 gallons. It is mounted on 100,000-lb. trucks marked with that weight capacity. The tank is made of ¼-in. plates and is 7 ft. 4 in. internal diameter and 32 ft. 10 in. long between centers of the heads. It is built up of only three rings, each ring having only one longitudinal seam. All the seams are double lap riveted. The dome is of 5-16 in. plate, is 18 in. high, 5 ft. 4 in. long and 3 ft. 4 in. wide with a circular manhole opening 15 in. in diameter. The discharge valve in the bottom of the tank is operated by a handle in the dome, which pulls up and raises the valve off its seat through a reach rod extending down through the tank. The handle, spring and rod are supported by a light angle riveted across the inside of the dome.

The underframe consists of two 10-in., 15 lb. channel center sills spaced 15 in. apart and two 12-in., 20.5 lb. channel side sills, spaced 3 ft. 10⅞ in. apart, tilted at the proper angle to bring the webs normal to the circumference of the tank at the point of contact. Hard-wood slabbing, 2 3/16 in. thick, is inserted between the top flange of the side sill channels and the tank, and slightly thicker pieces on the top flanges of the center sills and over the bolster. The bolster is a special steel casting made in three parts and shaped to fit in around all four longitudinal sills. The three pieces are tied together with a top plate, ¾ in. x 12 x 27 in., and by the body center plate which is a separate casting. An *I*-beam section is preserved in all the bolster castings with webs and flanges ¾ in. thick. The side bearings are cast on the two outside pieces.

A ⅜-in. plate cut approximately to the shape of

a segment of a circle forms the end sill and it is attached to the longitudinal sills with heavy angles. Bearing against the back side of this plate and in between the center sills is riveted a heavy casting which serves as a striking block for the coupler horn. The carry iron is an angle bolted to two lugs projecting from the bottom of this casting. The tank head-block is a piece of hardwood 5 in. x 10¾ in. x 21 in. cut out to fit the curve of the tank head. It rests directly on the center sills and is backed up with a ribbed casting which is riveted to the top flange of the center sills and comes out against the end sill plate.

The tank is held down on the frame with four tank bands 3 in. x ½ in.; one over each bolster and two near the center, on each side of the dome. Those at the bolsters are attached by turnbuckles to 12 in. x ⅝-in. straps riveted to the side castings of the bolster with four ¾ in.-rivets. In the center, the straps pass under all four sills, being riveted to each, and fasten to the tank bands with turn buckles on each side. The sills are braced apart at these points by angle spreaders.

In the bottom of the tank are four steam pipes arranged with the necessary connections outside the tank at each end, to attach to a steam line at unloading points to accelerate the discharge of thick oils in cold weather.

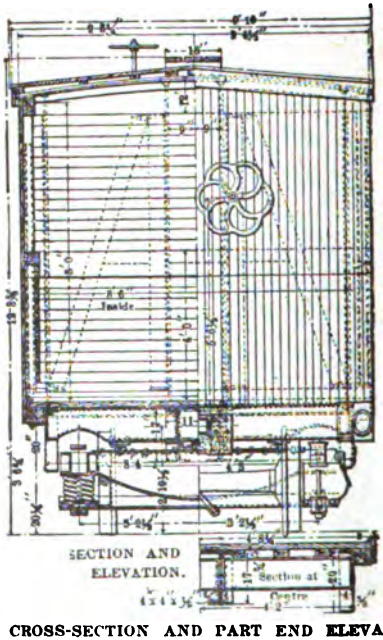
The Adaptation of Steel in the Construction of Box Cars is shown by illustrations Figures 171, 172, 173, 174. The same general construction is used for

Refrigerator Cars as shown in illustrations Figures 175 and 176.

The box and refrigerator cars have as a back-

bone two pressed steel center sills. These have 4 in. flanges and are 17 in. deep at the center of the car for a length of 10 ft. At the ends, the sills taper to a depth of 10 in. The side sills are 20 in. deep at the center. The neutral axis of the center

Fig. 173



PART CROSS-SECTION AND PART END ELEVATION.

sills is raised by using a cover plate 33 ft. 6 in. long extending almost the full length of the car and by the use of 4 x 4 x ½ in. flange angles riveted to the lower part of the webs of the center sills. These angles virtually change the center

sills into built-up *I*-beams. With center sills extending the full length of the car the bolsters are necessarily cut. They take the form of pressed

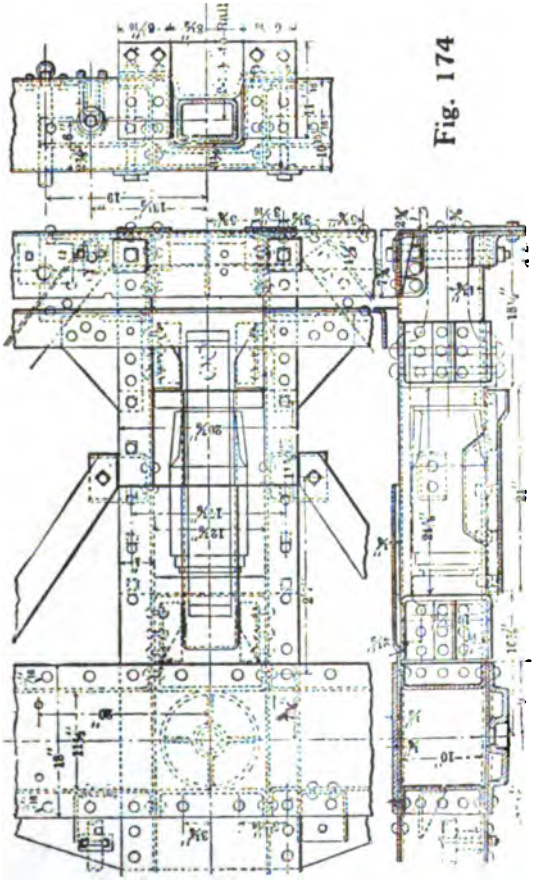
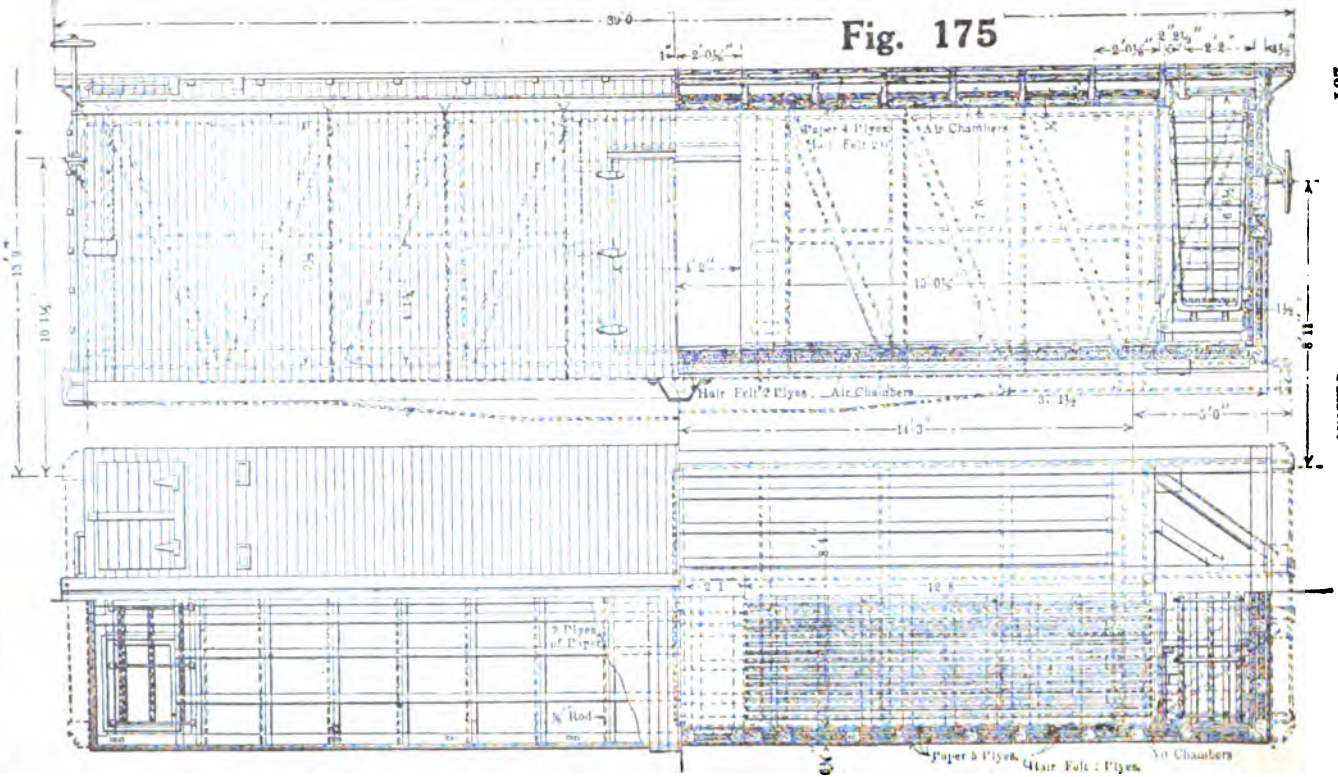


Fig. 174

DETAILS OF ATTACHMENT OF DRAFT GEAR STEEL FRAMED BOX CAR.

trough diaphragms with an 18 in. top cover plate extending across the car. This puts the bolsters

Fig. 175



THE ADOPTION OF STEEL IN THE CONSTRUCTION OF REFRIGERATOR CARS. PART SIDE ELEVATION AND PART LONGITUDINAL SECTION AND PLAN, OF REFRIGERATOR CAR.

into the shape of box girders. The transverse floor supports are pressed steel channels extending between the center and side sills, with short pieces between the center sills the portions

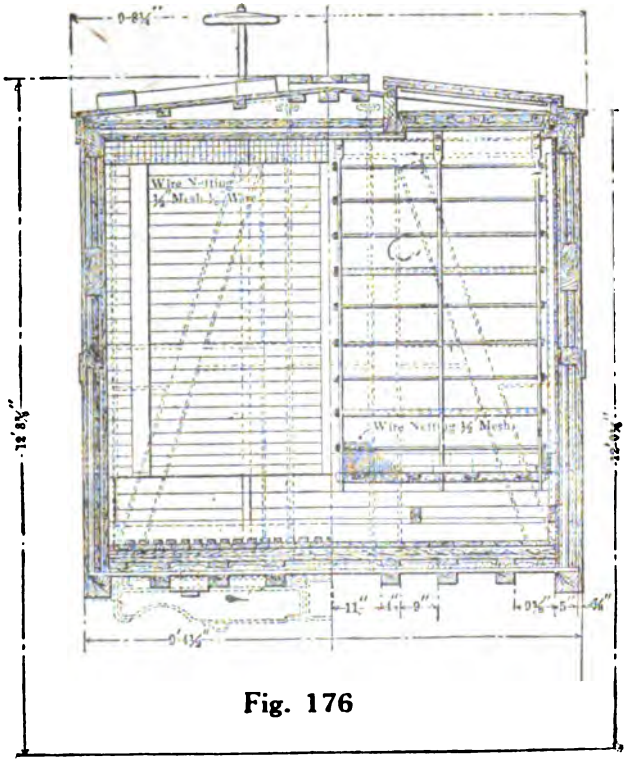


Fig. 176

CROSS-SECTION OF REFRIGERATOR CAR THROUGH THE ICE BOX.

between the center sills are 10 in. deep and those between the center and side sills are 7 in. deep. Upon the latter, the 3-in. wooden floor stringers

rest. At the upper and outer edges of the side sills Z bars are riveted, and these form the supports of the wooden side structure. This car has corner braces and pressed steel end sills. The draft gear is secured to the center sills, as indicated, and a special pair of diagonal braces serve to support the draft portions of the center sills. The body bolster, draft gear and end sill construction are clearly indicated in the drawing of the draft gear, which is of the Westinghouse type.

The wooden floor rests upon the 4 by 3 in. wooden floor stringers and these are supported on the diaphragms and on pressed steel brackets, at the ends, riveted to the bolsters, as indicated in the plan drawing. The weight of this car, empty is 45,300 lbs. It is designed for distributed loads.

The refrigerator car, has identically the same underframe as the box car. The upper frames are also similar, except as to end and side plates, intermediate carlines, door posts and belting boards. The floor and walls, also the roofs for the air chambers and the tanks for ice are special features of cars used for provisions and dairy products. The great weight of the body of the refrigerator car reduces the nominal capacity to 90,000 lbs. In the drawings, the construction of the superstructure and the insulation are indicated.

The illustrations Figures 177 and 178, show still another form of steel underframed box car which uses only commercial rolled bars in its construction.*

This car was designed to meet the demand for a structural underframe of ample strength but of

*Designed by George I. King. Built by Middletown Car Works.

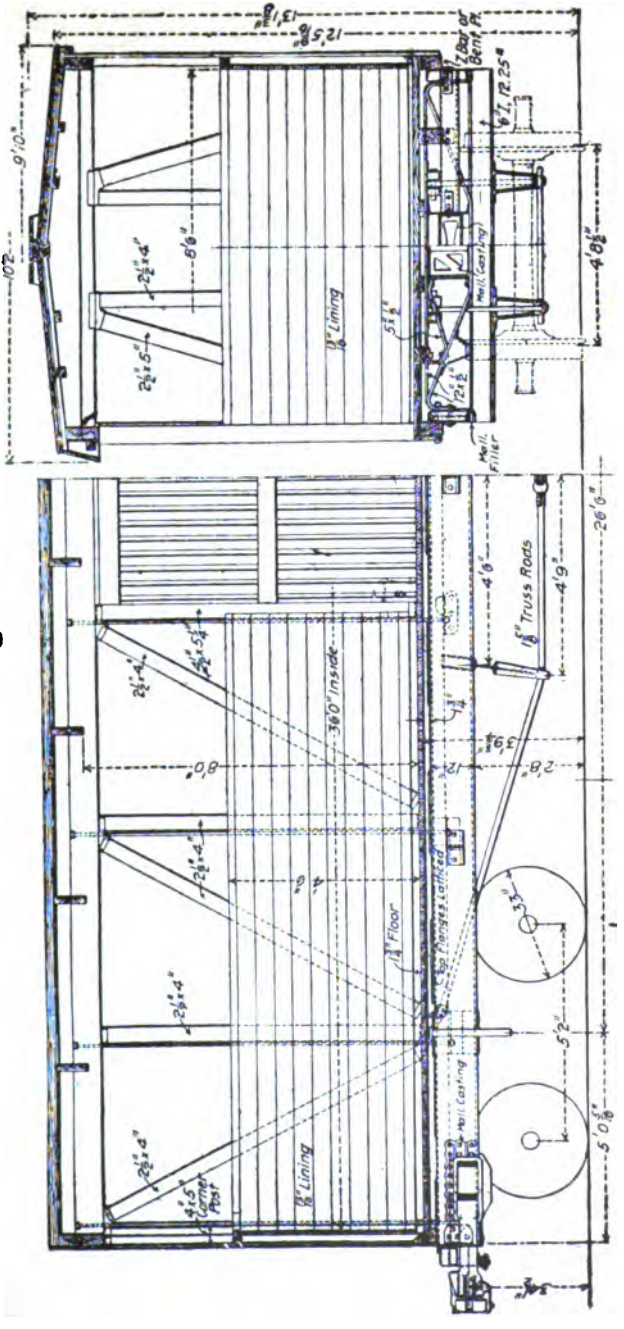
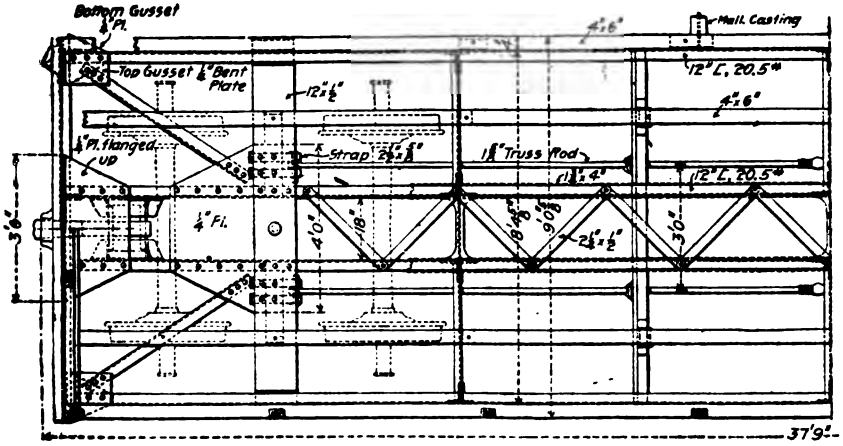


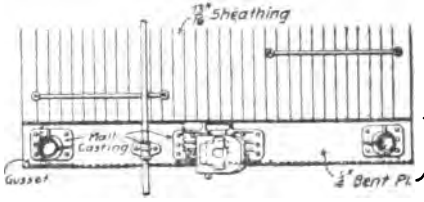
Fig. 177

30-TON BOX CAR—STEEL UNDERFRAME.



30-TON BOX CAR—STEEL UNDERFRAME.

Fig. 178



such simple type that it may not only be built in any ordinary railroad shop, but may be repaired with equal facility.

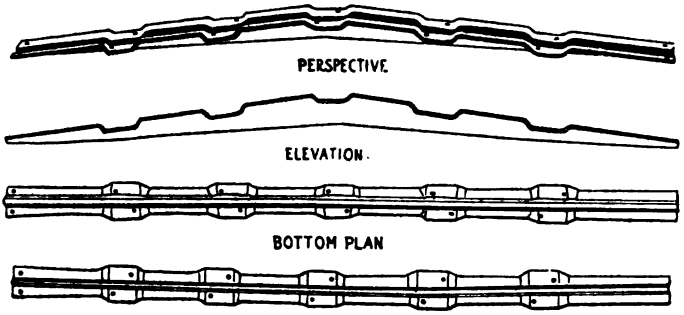
The four longitudinal sills are 12-in. channels, the center sills being trussed with 1⅝-in. rods between the bolsters.

The body bolsters are of 12 x ½-in. plates with 5 x ½-in. braces for the side bearings. Unique attachments of the body bolsters to the center sills and the truss rods to the body bolsters are shown. Two truss rods are used located near the center sills, where they will not interfere with the curving of the trucks or cause inconvenience with the side clearances of the car.

The gussets at the ends of the sills, are flanged up to form shoulders for the subsills, to secure the end frame from being pushed out by the load. The end sill is a ¼-in. plate bent into *Z* bar form, and is not secured in any way to the underframe except by means of the sill connection angles and the bottom corner gussets. It may therefore be easily removed for repairs without taking down the wooden structure. Though not shown in the drawing, the car is constructed with a small space of perhaps ½ in. between the inside face of the end sill and the outside face of the end sheathing to allow rainwater to drip through to the trucks. Because of the compressive stress in the center sills, due to the tension in the truss rods, the center sills are latticed together on top. The drawing also shows side sill brackets made of *Z* bars to support the side nailing strips. One of these is placed under each post and the brackets take the nuts for the sideframe truss rods. This form of bracket secures the nailing strips from side motion independent of the bolt connections.

In all the illustrations of cars shown the superstructure has been entirely of wood. Steel is gradually being used however for these details. For posts, braces, plates, etc., the plain rolled shapes are generally used but for the more irregular members pressed steel shapes are adopted. An example of pressed steel carlines is given in Figure 179 which shows the "Cleveland Pressed Steel Carline" (patented). Side stakes for gondola

Fig. 179



CLEVELAND PRESSED STEEL CARLINE.

cars, stake pockets, corner bands for both gondola and box cars etc. are also examples of details for which steel in the pressed shapes is being generally used.

For the steel carline the following claims are made: greater strength and rigidity of roof construction; reduction in number of carlines required (50 per cent being claimed); saving in dead weight; increased cubic capacity of car without change of outside dimensions as the height at

the eaves may be 2 to 4 inches less with the same inside dimensions; strengthening of side plates on account of the less cutting required; economy in repairs as the metal carline is said to be indestructible and finally adaptability to any style of car roof.

CHAPTER X.

STENCILING CARS.

In the early days of railroading the carrier was content simply to transport the freight over his own line, and, if it was to be delivered to a connection, to unload it at his own terminus and let the connection take it. But in these days a shipment of freight may, for instance, be loaded at New York and unloaded at San Francisco without ever leaving the car in which it was first placed. Consequently such a car will traverse the lines of many companies in carrying its load from point of origin to destination. It follows that the freight cars of the different railroad companies of the country are scattered in what would seem to be the wildest confusion all over the country.

It is apparent that under such circumstances it is of great moment that the carrier who takes a car from another road should be able to tell at a glance its salient mechanical features so that he may know how to handle it and how most quickly and efficiently to inspect it as to its condition. Accordingly every freight car is marked in various ways by letters or figures painted by means of stencil plates (hence the term "Stenciling"), which indicate the style or dimensions of certain of its parts such as the length and width, the style of coupler, draw bar attachments and brake beam; the size of journal

and axle; the kind of air brake with which it is equipped; and so on.

As this is a matter of concern to all companies alike and its efficacy depends upon uniformity of practice by railroads generally the Master Car Builders' Association has adopted as Standard the following rules on the subject:

"That on all box cars standing more than twelve (12) feet from top of rail to eaves, the width at eaves be stenciled in 3-inch letters on side of car, as near the bottom as convenient.

"That all box, stock and other roofed cars have the number and initials stenciled in 3-inch letters on outer face of outer floor timber between cross-tie timbers, except where cars are ceiled over underneath, in which case the stenciling shall be put on inside face of each cross-tie timber in center.

"That all classes of cars have style of coupler and rear attachments, and style of brake beams stenciled in not less than 1½-inch letters near one end of car on each side, or on each end of car directly above the buffer blocks where design of car permits it.

"That where the construction of the truck permits, trucks shall be stenciled on each side, giving the size of journal, and the letters 'M. C. B.', if the axle is M. C. B. standard axle. If the axle is not M. C. B. standard, use dimensions from center to center of journal in place of M. C. B. This stenciling to be in 1¼-inch letters, and to be put on end or side of bolster in Diamond trucks, and on side-truck frame in center on pedestal type of trucks.

"That on all cars equipped with air brakes, the words 'Air Brake,' in letters not less than 3 inches high, be stenciled on the sides or ends of the cars, and that the make of air-brake equipment be stenciled (in smaller letters if desired) over or just preceding these words, to enable inspectors to detect repairs made with wrong material. Initials of the road should also appear in letters not less than 2 inches high on one side of bolster or transom of each truck.

"All freight equipment cars used in interchange shall be stenciled with a letter 'B' on the end of car upon which the brake shaft is located and with the letter 'A' on the opposite end. On cars having brake shafts on both ends, the end toward which the brake cylinder push rod travels should be stenciled 'B', and the opposite end 'A'. The stenciling shall be in plain, black letters, not less than 1½ inches

high, enclosed in a circle not less than 2¾ inches in diameter, as shown in Figures 180 and 181.

"The location of the lettering to be as near the center line of end of car as convenient, and where possible be not less than ten inches, nor more than fourteen inches, above

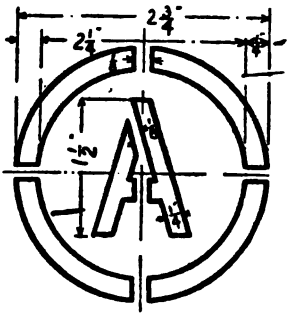


Fig. 180

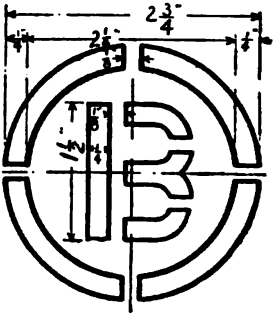
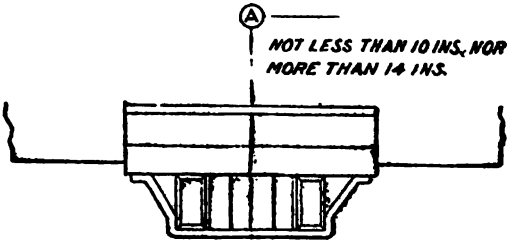


Fig. 181

FREIGHT CAR STENCILING.



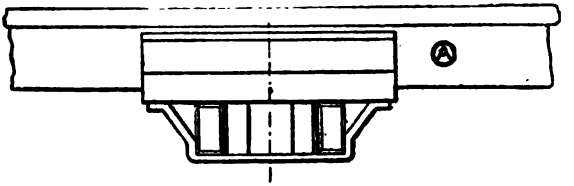
LOCATION OF LETTERING FOR BOX STOCK AND OTHER CARS HAVING FIXED ENDS

Fig. 182

FREIGHT CAR STENCILING.

the buffer block, on box, stock and other classes of cars having stationary ends, and to be located on the end sill near the buffer block, or on the face of the buffer block, near the top, on other classes of cars. See Figures 182, 183 and 184."

The Association of American Railway Accounting Officers has adopted the following rules on the subject of stenciling the weights on freight cars, and its recommendations are followed out



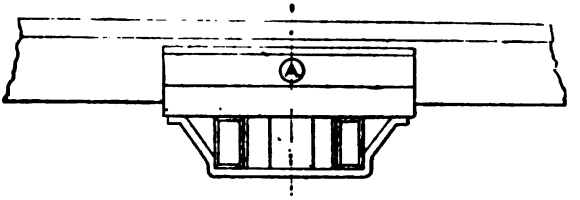
LOCATION OF LETTERING FOR FLAT AND OTHER CARS NOT HAVING FIXED ENDS.

Fig. 183

FREIGHT CAR STENCILING.

by the railway companies as an almost universal practice.

"1. The correct light weighing and stenciling of freight cars is a matter of very great importance, and it would



LOCATION OF LETTERING FOR FLAT AND OTHER CARS NOT HAVING FIXED ENDS

Fig. 184

FREIGHT CAR STENCILING.

pay the railroads of this country to go to considerable expense to have it done periodically and systematically by competent men.

"2. Freight cars, both home and foreign, irrespective of

where they may be found, should be weighed and stenciled once a year. Any car without stenciling should be immediately weighed and stenciled.

"3. New cars should be weighed and stenciled with the actual weight immediately before being put into service, and again when the stenciling is more than six months old.

"4. Cars which have received general repairs should be weighed and stenciled, with the actual weight, immediately before being put back into service.

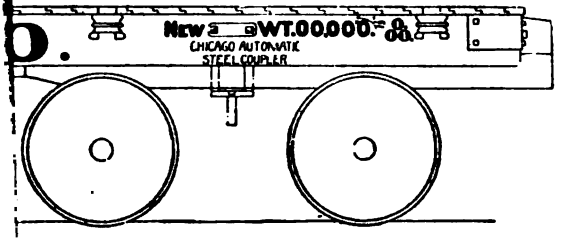
"5. A reasonable and uniform charge should be made on the owning road for the weighing and stenciling of foreign cars."

In marking cars to show their ownership and to distinguish the individual car it is fast becoming a standard practice to put the initials or name of the owner on the left hand quarter of the side and the number on the right hand quarter. Where a distinctive monogram is used it is shown with the number. This is illustrated, together with other standards already mentioned, in Figure 185 which shows the lettering of box cars as used by a well known railway. Figures 186, 187, 188 and 189 show the variations of the stenciling to suit a gondola, a flat, a stock and an ore car.

Where a railroad company has the same initials as another railroad company the practice is to stencil the name in full on some part of the car where it may be readily seen.

The following practice as shown in Figure 190 is recommended for stenciling Fast Freight Line Cars.

1. The half of sides of car on which the doors do not slide, to show the name of the "Fast Freight Line," spelled out in full, and the car number, in the Fast Freight Line series, immediately below it. In the same panel and within two feet of the sill shall appear, in letters not over four inches high, the name of the railroad company owning or contributing the car, and between the same and the sill shall appear the light weight of the car, with such other


New
WT.00,000.
CHICAGO AUTOMATIC
STEEL COUPLER

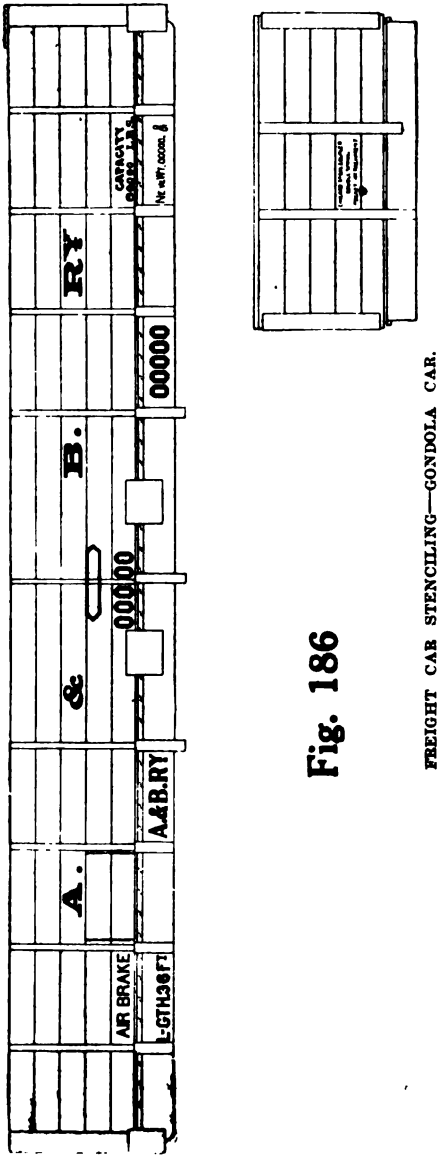
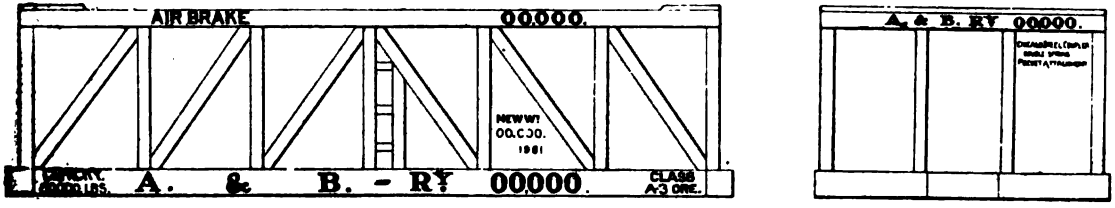


Fig. 186

FREIGHT CAR STENCILING—GONDOLA CAR.

Fig. 189



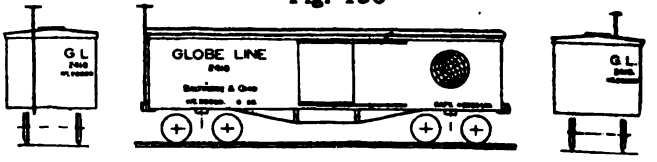
FREIGHT CAR STENCILING—ORE CAR.

information as it is found advisable to give in connection with same.

2. Side doors to bear the initials of the road to which the car belongs, or the name of the line on which the car is used, together with the number of the car.

3. The ends to show the initials of the "Fast Freight Line," with the car number, in the Fast Freight Line series,

Fig. 190



MARKING FAST FREIGHT LINE CARS

and the light weight just below them; no other marks will appear on ends of car.

4. The half sides of cars on which the doors do slide, to be reserved for advertising symbols or trade marks where used. The use of profuse lettering in this panel is to be discouraged, however, and it is recommended that only the simplest trade marks or advertising signs shall be used; the capacity of the car to appear near the sill in this same panel.

CHAPTER XI.

CAR INSPECTORS.

THEIR EXAMINATIONS—INSPECTING AIR BRAKES—EXAMINATION QUESTIONS AND ANSWERS ON AIR BRAKE.

There is no more important duty to be performed in the operation of railways than that of inspecting cars. The office requires that the incumbent shall be a man of good judgment and practical experience in the construction and operation of cars; he must also be reliable and honorable, doing his work thoroughly and conscientiously, for it is of such a nature that it can often be slighted without discovery. That the Car Inspectors of the country generally are possessed of all these qualifications there can be no doubt. In his vocation the senses of sight and hearing must be perfect if not acute and as they become impaired his efficiency decreases.

It is generally considered that the experience necessary to fit a man for the position of Car Inspector shall have been at least one year's service oiling cars and two years at car repairing; that men shall not be employed after attaining 30 years of age and shall not be promoted to the position after having attained the age of 40 years.

Vision, as has been mentioned, is an important factor and the general requirements are 20-20 in

one eye and not less than 20-40 in the other without glasses.

The following rules governing car inspectors have been recommended by the Master Car Builders' Association:

REQUIREMENTS.

One year at oiling cars.
Two years at car repairing.
Age limit for new men, thirty years.
Age limit for promoted men, forty years.
Vision, 20-20 in one eye and not less than 20-40 in the other without glasses.

METHOD OF TESTING.—*Acuity of Vision.*—The test card should be hung in a good light and the party to be examined should, if possible, be seated with his back to the window. Each eye should be examined separately, using, for the purpose of excluding one eye, a folded handkerchief. The lowest line that can be read should be determined by exposing only one letter at a time through a hole cut in a strip of cardboard. In making out the report in each case, the visual acuity of each eye should be denoted by a fraction of which the numerator represents the number of feet at which the applicant is seated from the card, while the denominator represents the number of feet at which the lowest line which he can read should be read. Thus, if at 20 feet he reads the line marked 20 feet, his vision—20-20 or 1, which is the normal standard. If at the same distance he only can read the line marked 70 feet, his vision—20-70. If at 20 feet he reads the 15-foot line, the vision—20-15, or more than normal. If a room 20 feet long cannot be used, a testing distance of 15 or 10 feet should be employed, in which case normal vision would be represented by 15-15 or 10-10 respectively, and lower grades of vision by such fractions as 15-20, 10-70, and so on.

Field of Vision.—Test should be made by having the applicant and examiner stand about three feet apart, each with one eye shut, looking each other steadily in the eye. The examiner should then bring his hand in from the edge of the field toward the center of the space, between them until the applicant sees it coming. This should be done from different directions, up, down, and from each side. The applicant should see the hand coming about as soon as the examiner does. If not, this should be noted on the report.

Hearing.—Test should be made in a quiet room. First, the examiner should hold the watch opposite the ear to be

examined not less than 48 inches distant, then gradually approach the ear until the applicant hears the tick, the stop being used to satisfy the examiner that the applicant is not deceiving. The distance at which the applicant hears the watch should be noted in inches. The normal ear should hear the tick of the watch at 48 inches. Then the hearing power will be denoted by a fraction whose numerator represents the number of inches at which the watch is heard. Thus, if he hears the watch at 48 inches his hearing—48-48, or normal. If he hears it at only 10 inches distant his hearing—10-48, and so on.

Color.—The committee does not think it essential that inspectors should be rejected on account of imperfect color sense. It is, however, believed that inspectors should be tested as to their color sense so that they, as well as their employer, may know their condition in this respect.

Educational.—The applicant should be able to write a legible hand in English, and also read manuscript matter as well as printed matter.

Car Knowledge.—The inspectors should be able to name each part of the cars in general use, in preference using M. C. B. dictionary terms.

M. C. B. Rules.—Inspectors must pass a satisfactory examination on M. C. B. rules, answering seventy-five per cent of the questions submitted. These questions should be of about the following character:

1. What are the Master Car Builders' rules?
2. What is the object of the M. C. B. rules?
3. What is the underlying idea or principle of these rules?
4. When is a company, operating the cars of another company, responsible for defects of such cars?
5. When a company is thus responsible, what should it do?
6. What care should be given to foreign cars by the company hauling them?
7. What cars must be accepted in interchange?
8. What is a defect card and how is it used?
9. Under what conditions is a road obliged to accept a car which is carded for defects for which the owner is not responsible?
10. What are the defects of wheels and axles for which owners and delivering companies are responsible?
11. Describe the form and use of the M. C. B. wheel gauge.
12. What are the rules which apply to the cleaning of triple valves and cylinders?
13. What does the limit of height of drawbars mean?

14. When a company is obliged to make improper repairs, what must it do to call attention to such repairs?
15. What does the term unfair usage mean?
16. What are the rules regarding splicing sills?
17. What is the purpose of the repair card?
18. How do these rules apply to switching roads?
19. Are switching roads allowed to render bills against owners direct for repairs of any other defects than those named in Section 23 of Rule 5?

The following rules as outlined by the Master Car Builders' Association should be observed in the cleaning of air brakes:

INSPECTION AND CLEANING OF TRIPLE VALVES.

The triple valve should be removed from the car for cleaning in the shop, and should be replaced by a triple valve in good condition. It should be dismantled, and all the internal parts, except those with rubber seats and gaskets, immersed in kerosene oil to soften the accumulated oil and gum. No hard metal should be used to remove gum or dirt, or to loosen the piston packing ring in its groove, as the almost inevitable result will be damage to some vital part of the triple. Particular pains should be taken in cleaning the feed groove not to enlarge it. Rags, or better still, chamois skins, should be used rather than waste, as the latter invariably leaves lint on the parts on which it is used. Great care must be used in removing the emergency valve seat, as this is frequently found bruised and distorted in triples which have been cleaned. The working parts should be carefully examined to know that they are in good order. Particular attention should be given the triple piston packing ring. It should have a neat fit in its groove in the piston, and also in the triple piston bushing. The fit of the packing ring in its groove and bushing and the condition of the bushing should be such as to pass the prescribed tests. The graduating stem should work freely in its nut, and the graduating spring be of standard dimensions and free from corrosion. The slide valve, triple piston packing ring and bushing should be lubricated with a few drops of light-bodied, high-grade mineral lubricating oil, such as dynamo oil; but the emergency piston, valve and check should not be oiled.

Should the triple piston packing ring need to be renewed, or the bushing require truing, we strongly recommend that such work be done by the manufacturers. We are thoroughly convinced that the average workman can not, or, at least,

does not do work of this kind satisfactorily, and that by far the largest proportion of the attempts to economize in this way results in inefficient air brakes and slid, flat wheels. It also permits a departure from the maintenance of standards in the several parts, which can not but result in demoralization in repairs.

Usually, sufficient attention is not paid to the condition of the emergency parts of the triple, as shown by their condition. The emergency valve seat is found damaged, the stem bent, the rubber seat imperfect and the check valve not properly fitting in a number of cases. These facts account for a large number of slid, flat wheels.

The cylinder cap gasket and check valve case gasket should be carefully examined and cleaned by using a cloth. They should not be scraped with a metal tool. Judging by an examination of a number of triples, these gaskets should be renewed more frequently than they are.

Before assembling the parts after cleaning, the casings and body of the triple should be thoroughly cleaned out with a blast of compressed air. In taking down and replacing the emergency parts of the triple, the greatest care should be exercised not to injure any of them. More damage is done by careless workmen in taking down these parts than is done in replacing them.

When replacing the triple valve on the auxiliary reservoir, the gasket should be fitted to the triple instead of the reservoir. Home made gaskets should be avoided, and standard gaskets of the manufacturer be used. Reports have been made where triple pistons have been found bent, due to the use of gaskets of irregular thickness, and trouble has been experienced in using gaskets which are too thick or too thin.

CLEANING AND INSPECTION OF THE BRAKE CYLINDER.

The brake cylinder need not be removed from the car for cleaning. First secure the piston rod firmly to the cylinder head, then, after removing the cylinder head, piston rod, piston head and release spring, scrape off all deposits of gum and dirt with a narrow putty knife or its equivalent, and have the removed parts wiped with waste saturated with kerosene or other light oil. The packing leather should never be permitted to soak in kerosene oil, as the penetrating qualities of kerosene reach into the pores of the leather, and force out the life-giving qualities of the special oil in which the leather is treated by the manufacturer. Particular attention should be paid to cleaning the leakage groove and the brake cylinder tube. The packing leather and expander ring should receive their share of proper inspection and cleaning. The expander ring should

be of a circumference which shall fit the bore of the brake cylinder when the ring is removed from its place between the follower and packing leather and entered in the cylinder. In all cases the follower nuts should be drawn up snugly before replacing the piston, and the inside of the cylinder and the packing leather evenly coated with a suitable grease or vaseline. A goodly quantity of grease should be placed on the expander ring and the adjacent side of the packing leather, thus permitting the pressure to force the grease into the leather and giving it greater life.

No sharp tool should be used in getting the packing leather into the cylinder. After the piston is in place and before the cylinder head is fastened on, the piston rod should be slightly rotated in all directions about three inches from the center line of the cylinder, in order to be certain that the expanding ring is not out of place. The old stencil marks should be removed. The auxiliary reservoir should be stenciled on both sides, with the date and place of cleaning, using white lead for the purpose; and if the car belongs to a foreign road, a repair card should be attached, as provided by the rules. The bolts or nuts holding the cylinder and reservoir to the car should be tightened.

TESTING TRIPLES.

After cleaning and repairing, it is essential that triples be tested and come within required limits, if a reasonable efficiency of the air brakes is to be maintained.

Test No. 1.—The tightness of the slide valve, the emergency and check valves and all joints should be determined by painting with soap suds.

Test No. 2.—Maintaining a pressure of ninety pounds in the train pipe, the auxiliary reservoir should reach seventy pounds in not less than forty-five seconds or more than sixty seconds, as provided for in Test No. 9 of the M. C. B. Air-brake Tests Code.

Test No. 3.—To test repaired triples for release, charge the auxiliary to seventy pounds pressure and make a full service reduction of twenty pounds, or until the auxiliary and cylinder pressure are equal. Place the special cutout cock in such position that pressure must pass through the 3/64-inch port, and turn main reservoir pressure of ninety pounds into the train pipe. If the triple does not release under these conditions, it should be condemned.

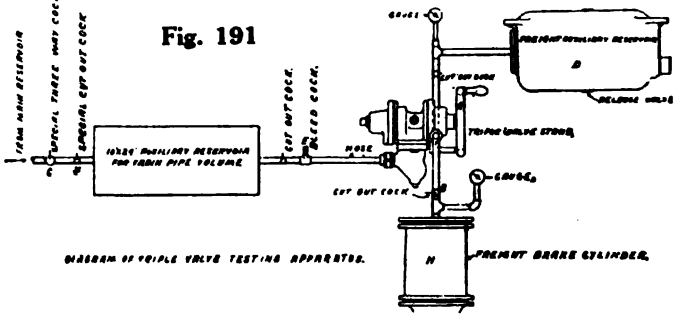
Test No. 4.—The triple piston packing ring should be tested for leakage by blocking the piston in the graduating position, preferably by use of the device shown at "A" in the accompanying diagram (Figure 191), maintaining the drain pipe pressure at seventy pounds. Under these conditions the

pressure in the auxiliary reservoir should not increase faster than fifteen pounds per minute.

The following are the Instructions for Car Inspectors as prepared by the Master Car Builders' Association:

GENERAL.—It is the duty of all inspectors to see that the couplings, the pipe joints, the triple valves, the high speed reducing valve, the conductor's valves, the air signal valves, and all other parts of the brake and signal apparatus are in good order, of standard size for the car and free from leaks. For this purpose they must be tested under the full air pressure as used in service. No passenger train

Fig. 191



must be allowed to leave a terminal station with the brake upon any car cut out, or in a defective condition, without special orders from the proper officer.

If a defect is discovered in the brake apparatus of a freight car, which cannot be held long enough to give time to correct such defect, the brake must be cut out and the car properly carded, to call the attention of the next inspector to the repairs required.

Special rules will specify the smallest proportion of freight cars, with the air brakes in good condition, which may be used in operating the train as an air brake train.

MAKING UP TRAINS AND TESTING BRAKES.—In making up trains, the couplings must be united and the cocks at the ends of the cars all opened, except at the rear end of the last car, where the cocks must be closed; the inspector must know that the air is passing through the pipes to the rear end, and the couplings properly hung up to the dummy

couplings if so equipped. After the train is fully charged the engineman must be requested to apply the brakes. When the brakes have been applied, they must be examined upon each car to see that they are applied with proper piston travel. This having been ascertained, the inspector must signal the engineman to release the brakes. (In testing passenger brakes the American Railway Association train air signal whistle code for applying or releasing must be used, one of which signals must be given from the discharge valve on the rear car.) He must then again examine the brakes upon each car to note that all have released. If any defect is discovered, it must be corrected and the testing of the brakes repeated, until they are found to work properly. The inspector must then inform both the engineman and conductor of the number of cars with brakes in good order.

This examination must be repeated if any change is made in the make-up of the train before starting.

HIGH SPEED REDUCING VALVES ON LOCOMOTIVES AND TENDERS must be tested at least once every month, and adjusted to authorized pressure, if necessary, and cleaned and lubricated at least once in three months, and oftener if tests show that same is necessary.

CLEANING CYLINDERS AND TRIPLE VALVES.—The brake cylinders and triple valves must be kept clean and free from gum. They must be cleaned and lubricated as often as once in six months upon passenger cars, and once in twelve months upon freight cars. The dates of the last cleaning and lubrication must be marked with white paint on the cylinder or reservoir, in the space left opposite the words:

Cylinder, cleaned and lubricated.....
Triple, cleaned and lubricated.....

The triple valves and auxiliary reservoirs must be frequently drained, especially in cold weather, by removing the plug in the bottom of the triple valve and opening the bleed cock in the reservoir.

GRADUATING SPRINGS.—The graduating springs in the Westinghouse quick-action freight triple valves are .049 inch in diameter, nickeled-steel wire, 16 coils 2¾ inches free height, 29-64 inch inside diameter, and in passenger .08 inch diameter, nickeled-steel wire, 13¼ coils, 2⅝ inches free height, 29-64 inch inside diameter. The graduating springs used in the Westinghouse plain triple valve in locomotive service are made of phosphor-bronze wire, .083 inch in diameter, 12 coils, 2½ inches free height, 25-64 inch inside diameter.

ADJUSTMENT OF BRAKES.—The slack of the brake shoes must be taken up by means of the dead truck levers.

In taking up such slack it must be first ascertained that the hand brakes are off, and the slack is all taken out of the upper connections, so that the truck levers do not go back within one inch of the truck timber or other stop, when the piston of the brake cylinder is fully back at the release position. When under a full application the brake piston travel is found to exceed nine inches upon passenger or freight cars, the brake shoe slack must be taken up and the adjustment so made that the piston shall travel not less than six inches. In taking up the brake shoe slack it must never be taken up by hand brakes. Where automatic slack adjusters are applied to any car, such adjuster must be fully released before the slack is taken up elsewhere.

BRAKING POWER.—Where the cylinder lever has more than one hole at the outer end the different holes are for use upon cars of different weights.

It must be carefully ascertained that the rods are connected to the proper holes, so that the correct braking power shall be exerted upon each car.

REPAIR PARTS.—Inspectors must keep constantly on hand for repairs a supply of all parts of the brake and signal equipment that are liable to get out of order.

HANGING UP HOSE.—Inspectors must see that, when cars are being switched or standing in the yard, the hose is coupled between the cars or properly secured in the dummy couplings, when cars are so equipped.

RESPONSIBILITY OF INSPECTORS.—Inspectors will be held strictly responsible for the good condition of all the brake and signal apparatus upon cars placed in trains at their stations; they will also make any examination of brake apparatus or repairs to the same which they may be called upon to do by trainmen.

*General Questions and Answers Thereto Regarding the use of the Air Brake and Train Air Signal.**—As the air brake plays such an important part in the running of trains it is expected by railway managers that all persons having to do with the use, adjustment, care or repairs of air brakes should be thoroughly examined on the following lines even although such questions may not relate especially to the immediate duties they are performing.

*These questions and answers were formulated by the Master Car Builders' Association.

GENERAL.

(All parties who have to do with the use, adjustment, care or repair of air brakes should be thoroughly examined on these questions, in addition to the special questions for each class of men following them.)

1. Question. What is an air brake?

Answer. It is a brake applied by compressed air.

2. Q. How is the air compressed?

A. By an air pump on the locomotive.

3. Q. How does the compressed air apply the brakes?

A. It is admitted into a brake cylinder on each car, and it pushes out a piston in that cylinder which pulls the brake on.

4. Q. How does the piston get back when the brakes are released?

A. There is a spring around the piston rod which is compressed when the brakes are applied, and when the air is allowed to escape to release the brakes, the spring reacts and pushes the piston in again.

5. Q. Where is the compressed air kept ready for use in the automatic air brake?

A. In the main reservoir on the locomotive, in the smaller or auxiliary reservoir on each car, and in the train pipe.

6. Q. Where does the compressed air come from directly that enters into the brake cylinder when the automatic brake is applied?

A. It comes from the auxiliary reservoir on each car in service application, and from the auxiliary reservoir and train pipe in emergency application.

7. Q. How does it get into the auxiliary reservoir?

A. It is furnished from the main reservoir on the locomotive through the train pipe and triple valve when the brakes are released.

8. Q. How is the automatic brake applied and released?

A. The automatic brake is applied by reducing the air pressure in the train pipe below that in the auxiliary reservoir, and is released by raising the train pipe pressure above that remaining in the auxiliary reservoir.

9. Q. Why does the compressed air not enter directly into the brake cylinder from the train pipe?

A. Because the triple valve used with the automatic brake prevents the air from entering directly from the train pipe to the brake cylinder when the pressure in the train pipe is maintained or increased.

10. Q. What other uses has the triple valve?

A. It causes the brake cylinder to be opened to the atmosphere under each car, to release the brakes when the

pressure in the train pipe is made greater than that in the auxiliary reservoir, and it opens communication from the train pipe to the auxiliary reservoir by the same movement; when the pressure in the train pipe is reduced it closes the openings from the train pipe to the auxiliary reservoir and from the brake cylinder to the atmosphere, and then opens the passage between the auxiliary reservoir and the brake cylinder by the same movement, so as to admit the air and apply the brakes.

11. Q. How many forms of triple valves are there in use, and what are they called?

A. Two; the plain triple and the quick-action triple.

12. Q. How can you tell the plain triple from the quick-action triple?

A. The plain triple has a four-way cock in it, with a handle for operating the cock; the quick-action triple has no such cock in it, but there is a plug cock in the cross-over pipe leading from the train pipe to the triple, when the quick-action triple is used.

13. Q. What are these cocks for in both cases?

A. They are to be used to cut out brakes on one car, without interfering with other brakes on the train, if the brake on that car has become disabled.

14. Q. How does the cock handle stand in the plain triple when the pipe is open for automatic action?

A. It stands in a horizontal position.

15. Q. In what position does the same handle stand when the brakes are cut out by closing the cock?

A. It stands at an inclined position midway between horizontal and vertical.

16. Q. How does the handle in the plug cock in the cross-over pipe, used with the quick action triple, stand for automatic action?

A. It stands with the handle crosswise with the pipe, and groove in plug lengthwise when cock is open.

17. Q. How does the handle and groove stand when the cock is closed and brake cut out of action?

A. It stands with the handle lengthwise of cross-over pipe, and the groove crosswise when closed.

18. Q. How is the train pipe coupled up between the cars?

A. By means of a rubber hose on each end of the train pipe, fitted with a coupling at the loose end.

19. Q. How is the train pipe closed at the rear end of train?

A. By closing the cock in the train pipe at the rear end of last car.

20. Q. How many such train pipe cocks are there to a

car, on the air brake train pipe and on the air signal train pipe, and why?

A. Two for each pipe on each car, because either end of any car may sometimes be at the rear end of the train.

21. Q. How many kinds of train pipe cocks are there in use at the ends of the cars?

A. Two.

22. Q. Describe each and give the position of the handle and groove for open and closed in each case.

A. The older form of train pipe cock is a straight plug cock in the train pipe, not far from the hose connection; the handle stands crosswise with the pipe when it is open, and lengthwise with the pipe when closed; it is now found principally on the air signal pipe. The other form of train pipe cock now used on the air brake pipe is an angle cock placed at the end of the train pipe and close to the hose. The handle of the angle cock stands lengthwise with the pipe when open, and crosswise with the pipe when closed. The groove is also a guide to tell whether open or closed.

23. Q. What uses have these train pipe cocks besides to close the pipe at the end of the train?

A. They are used to close the train pipe at both sides of any hose coupling which is to be parted, as when the train is cut in two.

24. Q. Why is it necessary to close the train pipe on both sides of the hose coupling before it is parted?

A. To prevent the escape of air from the train pipe, which would apply the brakes.

25. Q. How must the hose coupling be parted when it is necessary to do so, and why?

A. The air brake must first be released on the train from the locomotive, then the adjacent train pipe cocks must both be closed and the coupling must be parted by hand, to prevent the possibility of injury to the rubber gasket in the coupling.

26. Q. Why must the brakes be fully released before uncoupling the hose between the cars?

A. Because if the brakes are applied upon a detached car they can not be released without bleeding the auxiliary reservoir.

27. Q. In coupling or uncoupling the hose between cars, what must be done if there is ice on the couplings?

A. The ice must first be removed and couplings thawed out, so as to prevent injury to the rubber gaskets in uncoupling, and to insure tight joints in coupling the hose.

28. Q. What must be done with a hose coupling which is not coupled up, such as the rear hose of a train, or any hose on a car which is standing or running, but not in use?

A. It must be placed in the dummy coupling if provided for in such manner that the flat pad on the dummy will close the opening in the coupling.

29. Q. What pressure should be carried in the train pipe and auxiliary reservoir?

A. The authorized pressure, as per special instructions.

30. Q. Why should the authorized pressure be maintained?

A. Because this pressure is necessary to get the full braking force which each car is capable of using, and, if it be exceeded, there will be danger of sliding the wheels.

31. Q. How much pressure can be obtained in the brake cylinder by the service application of the brakes with seventy pounds in the auxiliary reservoir?

A. About fifty pounds to the square inch, with an 8-inch piston travel.

32. Q. Why can only fifty pounds pressure be obtained under these circumstances?

A. Because the air at seventy pounds pressure in the auxiliary reservoir expands into an additional space when the auxiliary reservoir is opened to the brake cylinder, and when the pressure has become equalized it is thus reduced to fifty pounds.

33. Q. How much must the train pipe pressure be reduced, in order to get fifty pounds pressure in the brake cylinder, in ordinary service?

A. Twenty pounds.

34. Q. Can the brakes be applied so as to get only a portion of this fifty pounds pressure in the brake cylinder, and how?

A. They can be so applied by reducing the train pipe pressure less than twenty pounds.

35. Q. If the train pipe pressure be reduced ten pounds what will be the pressure in the brake cylinder?

A. About twenty-five pounds.

36. Q. How is this graduated action obtained?

A. By means of the graduating valve in the triple valve.

37. Q. Is it important to keep all the air brake apparatus tight and free from leaks?

A. Yes.

38. Q. Why is this important?

A. In order to get full service from the air brakes, and to prevent the waste of air, and also to prevent the brakes applying automatically by reason of leak in the train pipe.

39. Q. Is it important to know that the train pipe is open throughout the train and closed at the rear end before starting out?

A. Yes, this is very important.

40. Q. Why is this very important?

A. Because if any cock in the train pipe were closed, all the brakes back of the cock which is closed would be prevented from working.

41. Q. How can you ascertain that the train pipe cocks are all open when the train is made up?

A. By testing the brakes; that is, by applying and releasing them, and observing whether they all operate.

42. Q. Do you understand that no excuse will be acceptable for starting out the train without first testing the air brakes?

A. Yes.

43. Q. Why is this rule absolute?

A. Because the safety of passengers and of property depends upon the brakes being properly coupled up and in an operating condition before the train is started.

44. Q. At what other times should the brakes be tested?

A. After each change in the make-up of the train and before starting the train down certain designated grades.

45. Q. From where does the air signal apparatus receive its pressure?

A. From the main air reservoir through the reducing valve.

46. Q. How much air pressure should be carried in the air signal train pipe?

A. The authorized pressure.

47. Q. Is it important that this train pipe and its connections be also kept tight?

A. Yes.

48. Q. After taking up the slack of the brake shoes, how far should the brake piston travel in the cylinders on cars and tenders with a full application of the brake?

A. Not less than six inches, nor more than nine inches.

49. Q. What would happen if the piston traveled less than six inches when brakes are fully applied?

A. A partial application of the brakes might not force the piston beyond the leakage groove in the brake cylinder provided for the escape of small amounts of air.

50. Q. Why should the piston travel not be permitted to exceed nine inches on passenger cars, tenders, or freight cars?

A. Because if it travels farther than this when sent out, a little wear of the brake shoes will cause the piston to travel far enough to rest against the back cylinder head when the brakes are applied, and this cylinder head would then take the pressure instead of its being brought upon the brake shoes.

51. Q. How far should the driver brake piston travel with a full application of the brakes, and why?

A. Not less than two inches nor more than three and one-half inches for the cam type of brake, and from four to six inches for other forms.

52. Q. If the brakes stick upon any car so that the engineman can not release them at any time, how should they be released?

A. By opening the release cock in the auxiliary reservoir and holding it open until air begins to escape from the triple valve and then closing it again.

53. Q. What is the pressure retaining valve, and what is its use?

A. The pressure retaining valve is a small valve placed at the end of a pipe from the triple valve, through which the exhaust takes place from the brake cylinder. It is used to retard the brake release on heavy grades, and holds the brakes partially applied, so as to allow more time for the engineman to recharge the auxiliary reservoir.

54. Q. What precautions are necessary on every train in regard to hose couplings?

A. Every train must carry at least two extra hose and couplings complete, for use in replacing any hose couplings which may fail or become disabled. These extra hose and couplings to be carried on such part of the train as is required by the rules and regulations.

SPECIAL FOR ENGINEMEN.

55. Q. How should the air pump be started?

A. It should be started slowly, so as to allow the condensation to escape from the steam cylinder and prevent pounding, which is more likely to occur when the air pressure is low.

56. Q. Why should the piston rod on the air pump be kept thoroughly packed?

A. To prevent the waste of air and steam.

57. Q. How should the steam cylinder of the air pump be oiled, and what kind of oil should be used?

A. It should be oiled as little as necessary through a sight-feed lubricator, and cylinder oil should be used.

58. Q. How should the air cylinder of the air pump be oiled; what kind of oil?

A. It should be supplied with valve oil as often as necessary, through a cup provided for that purpose. Also, a well saturated swab should be kept on the piston rod. Lard oil, and other animal or vegetable oils should not be used, as their use causes the brake valve and the triple valves to gum up. The oil must never be introduced through the air inlet ports, as this practice would cause the pump valves to gum up.

59. Q. What regulates the train pipe pressure?

A. The train pipe governor, or feed valve, provided for that purpose.

60. Q. Why should the authorized pressure be carried in train pipe?

A. Because this pressure produces the strongest safe pressure of the brake shoes upon the wheels. A higher train pipe pressure is liable to cause the wheels to slide.

61. Q. What does the feed valve attachment on the brake valve accomplish?

A. When properly adjusted it restricts the train pipe pressure to the authorized amount, with the brake valve handle carried in running position.

62. Q. How often should the brake valve be thoroughly cleaned and oiled?

A. At least once every two months.

63. Q. If the main valve in the brake valve is unseated by dirt or by wear, what may be the result, and what should be done?

A. It may be impossible to get the excess pressure; when the brakes have been applied they may keep applying harder until full on, or when they have been applied they may release. The main valve should be thoroughly cleaned, and if worn it should be faced to a seat.

64. Q. If the piston in the brake valve becomes gummed up or corroded from neglect to clean it, what will be the result?

A. It will be necessary to make a large reduction of pressure through the preliminary exhaust port before the brakes will apply at all, and then the brakes will go on too hard and will have to be released.

65. Q. How and why should the train pipe under the tender always be blown out thoroughly before connecting up to the train?

A. By opening the angle cock at the rear end of the tender and allowing the air from the main reservoir to blow through. This blows out the oil, water, scale, etc., which may accumulate in the pipe, and which would be blown back into the train pipe and triple valves if not removed before coupling to the train.

66. Q. When the locomotive is coupled to the train, why is it necessary to have excess pressure in the main reservoir?

A. So that the brakes will all be released and the train quickly charged when the engineman's valve is placed in the release position.

67. Q. Why should the driver brakes be operated automatically with the train brake?

A. Because it adds greatly to the braking force of the

train, and the brakes can be applied alike to all the wheels for ordinary stops, and in an emergency the greatest possible braking force is at once obtained by one movement of the handle.

68. Q. In making a service application of the brakes, how much reduction of the train pipe pressure from seventy pounds does it require to get the brakes full on?

A. About twenty-five pounds reduction.

69. Q. What should the first reduction be in such an application?

A. Not less than five pounds, so as to insure moving the pistons in the brake cylinders past the leakage grooves.

70. Q. What is the result of making a greater reduction of pressure than twenty-five pounds?

A. A waste of air in the train pipe, without getting any more braking force, and therefore requiring more air to release the brakes.

71. Q. How many applications of the brakes are necessary in making a stop?

A. One or two applications.

72. Q. Why is it dangerous to apply and release the brakes repeatedly in making stops?

A. Because every time the brakes are released the air in the brake cylinders is thrown away, and if it is necessary to apply them again before sufficient time has elapsed to recharge the auxiliary reservoirs the application of the brakes will be weak, and after a few such applications the brakes are almost useless on account of the air having been exhausted from the auxiliary reservoirs.

73. Q. In releasing and recharging the train, how long should the handle of the brake valve be left in the release position?

A. Until the train pipe pressure has risen nearly to authorized pressure.

74. Q. In making service stops with passenger trains, why should you release the brakes just before coming to a full stop?

A. So as to prevent stopping with a lurch; it also requires less time for the full release of the brakes after stopping.

75. Q. In making stops with freight trains, why should the brakes not be released until after the train has come to a full stop?

A. Because long freight trains are apt to be parted by releasing the brakes before rear brakes are fully released.

76. Q. In making service stops, why must the handle of the brake valve not be moved past the position for service applications?

A. So as to prevent unnecessary jerks to the train and the emergency action of the triple valve when not necessary.

77. Q. If you find the train dragging from the failure of the brakes to release, how can you release them?

A. By placing the handle of the brake valve in full release position for a few seconds and returning it to the running position, if the train pipe pressure is not up to the authorized amount; but if maximum pressure is in train pipe, the brakes should be applied with from five to ten pounds reduction, according to the length of train pipe, and released in the usual manner.

78. Q. When the brakes go on suddenly when not operated by the brake valve, and the gauge pointer falls back, what is the cause, and what should you do?

A. Either a hose has burst, or a conductor's valve has been opened, or the train has parted. In any event, the engine throttle should be closed and the handle of the brake valve should immediately be placed on lap position to prevent escape of air from main reservoir.

79. Q. Are the brakes liable to stick after an emergency application, and why?

A. The brakes are harder to release after an emergency application because they are on with full force and it requires higher pressure than usual in the train pipe to release them again. In this case it is necessary always to have in reserve the excess pressure of the main reservoir to aid in releasing the brakes. With the quick-action triple valve this is especially necessary, because air from the train pipe as well as from the auxiliary reservoir is forced into the brake cylinder when a quick application of the brake is made, thus increasing the pressure in the brake cylinder without the usual reduction of pressure in the auxiliary reservoir, and requiring a correspondingly high pressure in the train pipe afterward to cause the brakes to be released.

80. Q. In using the brakes to steady the train while descending grades, why should the air pump throttle be kept well open?

A. So that the pump may quickly accumulate a full pressure in the main reservoir for use in recharging the train pipe and auxiliary reservoir when the brakes have been released again.

81. Q. In descending a grade how can you best keep the train under control?

A. First, by commencing the application of the brakes early, so as to prevent too high a speed being reached; secondly, by making an initial reduction that will lightly apply all brakes in the train, and by slowing the train down just before it is necessary to charge the auxiliary reservoir, so

as to give time enough to refill same before much speed is again attained.

82. Q. If the train is being drawn by two or more locomotives, upon which locomotives should the brakes be controlled, and what must the engineman of the other locomotive do?

A. The brakes must be controlled by the leading locomotive, and the enginemen of the following locomotives must close the cock in the train pipe just below the brake valves. The latter must always keep the pump running and in order, and main reservoir charged with pressure, with the brake valve in the running position, so that he may quickly operate the brakes if called upon to do so.

83. Q. If the air signal whistle gives only a weak blast, what is the probable cause?

A. Either the reducing valve is out of order so that the pressure is considerably less than forty pounds, or the whistle itself is filled with dirt or not properly adjusted, or the port under the end of signal valve is partly closed by gum or dirt.

84. Q. If the reducing valve for the air signal is allowed to become clogged up with dirt, what will the result probably be?

A. The signal pipe might get the full main reservoir pressure, and the whistle will blow when the brakes are released.

85. Q. If you discover any defect in the air brake or signal apparatus while on the road, what must be done?

A. If it is something that can not be readily remedied at once, it must be reported to the Enginehouse Foreman as soon as the run is completed.

86. Q. What is the result if water be allowed to collect in the main reservoir of the brake apparatus?

A. The room taken up by the water reduces the capacity for holding air, and the brakes are more liable to stick. In cold weather also the water may freeze and prevent the brakes from working properly.

SPECIAL FOR ENGINE REPAIRMEN.

87. Q. How often must the air brake and signal apparatus on locomotives be examined?

A. After each trip.

88. Q. Under what pressure must it be examined?

A. Under full pressure.

89. Q. Should the train pipe pressure exceed the maximum, where would you look for the cause of the trouble?

A. In the devices controlling train pipe pressure.

90. Q. How often must the main reservoir and the drain cup under the tender be drained?

A. After each trip.

91. Q. How often must the triple valves and the cylinders of the driver and tender brakes be cleaned and lubricated?

A. They must be thoroughly cleaned and lubricated once every six months. If the driver brake cylinders are so located that they become hot from the boiler, they may require lubrication more frequently.

92. Q. If there are any leaks in the pipe joints or anywhere in the apparatus, what must you do?

A. Repair them before the locomotive goes out.

93. Q. How is the brake shoe slack of the cam driver brake taken up, and what precautions are necessary?

A. By means of the cam screws, and it is necessary to lengthen both alike, so that when the brake is applied the point of contact with the cams will be in a line with the piston rod.

94. Q. How is the brake shoe slack of driver brakes on a locomotive with more than two pairs of driving wheels taken up?

A. By means of a turnbuckle or screw in the connecting rods.

95. Q. How is the slack of the tender brake shoes taken up?

A. By means of the dead truck levers; if they will not take it up enough, it must be taken up in the underneath connection, and then adjusted by the dead lever.

96. Q. How far should the driver brake piston travel in applying the brakes?

A. Not less than two inches, nor more than three and one-half inches with the cam type of brake, and from four to six inches with other forms.

97. Q. What travel of piston should the tender brakes be adjusted for?

A. Not less than six inches nor more than nine inches, and such adjustment must be made whenever the piston travel is found to exceed eight inches.

SPECIAL FOR TRAINMEN.

98. Q. How should you proceed to test the air brakes before starting out, after a change in the make-up of a train, or before descending certain specially designated grades?

A. After the train has been fully charged with air, the engineman must be required to apply the brakes; when he has done so the brakes must be examined upon each car to

see that the air is applied and that the piston travel is not less than six nor more than nine inches. The engineman must then be required to release the brakes; after he has done so, each brake must be examined again to see that all are released. The engineman and conductor must then be notified that the brakes are all right, if they are found so. (In testing passenger brakes, the American Railway Association train air signal whistle code for applying or releasing must be used, one of which signals must be given from the discharge valve on the rear car.)

99. Q. In starting out a passenger train from an inspection point, how many cars must have the brakes in service?

A. Every car in the train.

100. Q. When might you cut out a brake upon a passenger car?

A. Never, unless it gets out of order while on the run, in which case it must be reported to the inspector at the end of the run, or upon the first opportunity which may give sufficient time to repair it.

101. Q. If a hose bursts upon the run what must be done, if the train is in a safe place?

A. The hose must first be replaced by a good one, and the engineman then signaled to release the brakes. The train must not proceed until the brakes have been reconnected and tested upon the train to see that all are working properly.

102. Q. If the train is not in a safe place when the hose bursts, what must be done?

A. The train pipe cock immediately ahead of the burst hose must be closed and the engineman signaled to release the brakes. The brakes at the rear of the burst hose must then be released by bleeding the auxiliary reservoirs, and the train must then proceed to a safe place to replace the hose and connect up the brakes, after which the brakes must be tested.

103. Q. If the train breaks in two, what must be done?

A. The cock in the train pipe at the rear end of the first section must be closed and the engineman signaled to release the brakes. The two parts of the train must then be coupled, the hose connected and the brakes again released by the engineman. When it is ascertained that the brakes are all released, the train may proceed.

104. Q. Explain how the pressure-retaining valves are thrown into action or thrown out of action, and when this must be done.

A. The pressure-retaining valve is thrown into action by turning the handle of the valve to a horizontal position,

and it is thrown out of action again by placing this handle in a vertical position pointing downward. This handle should be placed in a horizontal position at the top of a heavy grade, and it should always be returned to a vertical position at the foot of the grade, as otherwise the brakes will drag on any cars which still have the handle of the pressure-retaining valve in the horizontal position.

105. Q. If the brake of any car is found to be defective on the run, how should you proceed to cut it out?

A. By closing the cock in the cross-over pipe of the quick-action brake, or in the triple valve of the plain automatic brake, and then opening the release cock in the auxiliary reservoir upon that car, leaving it open, if a passenger car, or holding it open until all the air has escaped from it, if a freight car.

106. Q. When it is necessary to cut out a defective brake upon a car, why should it always be cut out at the triple valve and never by the train-pipe cock at the end of the car, even if it is the last car of the train?

A. The train pipe should always be open from the locomotive to the rear end of the last car, so that if the train breaks in two the brakes will be automatically applied before the parts of the train have separated sufficiently to permit damage to be done by their coming together again, and so that the brakes may be applied with the conductor's valve upon any car.

107. Q. Should the train pipe burst under any car, what must be done?

A. The train must proceed to the nearest switching point, using the brakes upon the cars ahead of the one with the burst pipe, where the car with the burst pipe must be switched to the rear of the train; the hose must then be coupled up to the rear car and the cock at the rear end of the next to the last car opened, and the cock at the forward end of the last car closed, so that if the train should part between the last two cars the brakes will be applied.

108. Q. What is the conductor's valve, and what is its use?

A. It is a valve at the end of a pipe leading from the train-brake pipe upon each passenger car; it is to be opened from the car in any emergency when it is necessary to stop the train quickly, and only then. When used it should be held open until the train is stopped, and then it should be closed.

109. Q. What is the air signal for, and how is it operated?

A. It is to signal the engineman, in place of the old

gong signal, and it is operated by pulling directly downward on the cord for one second and releasing immediately, allowing three full seconds to elapse between pulls.

110. Q. If the discharge valve on the air-signal system is out of order or leaking on any car, how can you cut it out?

A. By closing the cock in the branch pipe leading from the train-signal pipe to the discharge valve; to do so the handle of this cock should be placed lengthwise with the pipe.

111. Q. How is the slack taken up so as to secure the proper adjustment of piston travel?

A. By means of the dead-truck lever, and if that is not sufficient, one or more holes must be taken up in the underneath connection and the adjustment then made by the dead-truck lever. Where automatic slack adjusters are applied to any car, such adjuster must be fully released before the slack is taken up elsewhere.

SPECIAL FOR INSPECTORS.

112. Q. Do you understand that no passenger train may be started out with any of the brakes cut out of service?

A. I do.

113. Q. Why is it important that no leaks should exist in the air brake service.

A. Because they would interfere with the proper working of the brakes and might cause serious damage.

114. Q. What must be done with the air brake or air-signal couplings when not united to other couplings, on cars equipped with dummy couplings?

A. They must be secured in the dummy coupling, so that the face of the dummy coupling will cover the opening of the hose coupling so as to prevent dust and dirt from entering the hose.

115. Q. If the air issues from the exhaust port of the quick-action triple valve when the brakes are off, what is the cause?

A. It is probably due to dirt on the rubber seated emergency valve.

116. Q. How often must the cylinder and triple valves be examined, cleaned and lubricated?

A. As often as once every six months on passenger cars and once in twelve months on freight cars. The dates of the last cleaning and lubrication must be marked with white paint on the cylinders.

117. Q. What is the difference between the quick-action passenger and freight triple valve?

A. The passenger triple valves have larger ports and slide valves.

118. Q. How may a passenger triple valve be distinguished?

A. By having one exhaust outlet, or suitable lettering designating the class of service.

119. Q. How may a freight triple valve be distinguished?

A. By its two exhaust outlets, one being plugged.

120. Q. When should the graduating spring of the triple valve be replaced with a new one?

A. When it is worn or rusted out, or not of standard size.

121. Q. To what travel of piston must the brakes be adjusted?

A. Not less than six inches, and this adjustment must be made whenever the piston travel is found to exceed nine inches.

122. Q. How is the slack taken up so as to secure this adjustment?

A. By means of the dead-truck lever, and if that is not sufficient one or more holes must be taken up in the underneath connection and the adjustment then made by the dead-truck lever. Where automatic slack adjusters are applied to any car, such adjuster must be fully released before the slack is taken up elsewhere.

123. Q. What are the different holes in the outer end of the cylinder levers for, and why must the connections be pinned to the proper hole for each car.

A. These holes are to enable the adjustment of the brake pressure to be made according to the weights of the different cars. The connection must be made to the proper hole in each case, according to the weight of the car, so as to give proper braking power, otherwise the brake will be inefficient, or the wheels may be slid under the cars.

124. Q. How many sizes of high speed brake-reducing valves are there in use, and how will it be known to which size of cylinders they should be connected?

A. There are three sizes, namely, one for 8-inch, one for 10-inch and 12-inch, and a third for 14-inch and 16-inch cylinders, and they can be distinguished by the raised figures cast on their body.

125. Q. To what pressure must the high speed brake-reducing valve be adjusted on passenger equipment cars?

A. The authorized pressure.

CHAPTER XII.

CODE OF RULES GOVERNING THE CONDITION OF, AND REPAIRS TO, FREIGHT AND PASSENGER CARS FOR THE INTERCHANGE OF TRAFFIC AS ADOPTED BY THE MASTER CAR BUILDERS' ASSOCIATION.

These rules make car owners responsible for, and therefore chargeable with, the repairs to their cars necessitated by ordinary wear and tear in fair service, so that defect cards will not be required for any defects thus arising.

Railroad companies handling cars are responsible for damage done to any car by unfair usage, derailment or accident, and for improper repairs made by them, and they should make proper repairs at their own expense, or issue defect card covering all such damage or improper repairs.

CARE OF FOREIGN FREIGHT CARS.

Rule 1. Each railway company shall give to foreign cars, while on its line, the same care as to oiling, packing and inspection, that it gives to its own cars.

INTERCHANGING FREIGHT CARS.

Rule 2. Cars offered in interchange must be accepted if in safe and serviceable condition, the receiving road to be the judge in cases not provided for in Rules 3 to 54, inclusive.

INSTRUCTIONS FOR INSPECTORS.

USE OF DEFECT CARD.

Rule 3. Defect cards shall be 3½ inches by 8 inches, and of the form shown below. They should be printed in red ink on both sides, and shall be filled in on both sides with ink or black indelible pencil. The cards must plainly specify in full each item for which charges are authorized, indicating on which end of the car the defects exist. The end of the car upon which the brake staff is located shall be known as "B" end, and the opposite end shall be known as "A" end. Where there are two brake staffs on same car, the end toward which the cylinder push rod travels shall be known as "B" end.

M. C. B. DEFECT CARD.

(*Name of Road.*)

Car No.....Date.....

Initial.....Line.....

Will be received at any point on this company's line with the following defects:

Note—Fill in defects on both sides with ink or black indelible pencil. Attach this card with four tacks on outside face of intermediate sill, between cross-tie timbers.

.....

.....

.....

.....Inspector at.....

Send bill on this card to .....

Rule 4. Defect cards shall not be required for defects for which owners are responsible, except for missing material on cars offered in interchange, as provided for in Rules 27 and 39, neither shall they be required of the delivering road for improper repairs that were not made by it, with the exception of the cases provided for in Rules 31, 40, 41, 42 and 43.

Rule 5. If a car has defects for which the owners are not responsible, but which do not render it unsafe to run, nor unsafe to trainmen, nor to any lading suitable to the car, the receiving road may require that a defect card be securely attached to the car with four tacks, preferably on the outside face of intermediate sill, between cross-tie timbers.

Rule 6. Duplicate defect cards shall be furnished for lost or illegible cards.

WHEELS.

DEFECTS OF WHEELS WHICH JUSTIFY RENEWAL.

Owners responsible (Rules 7 to 18):

Rule 7. Shelled out; wheels with defective treads on account of pieces shelling out; if the spots are over 2½ inches, or are so numerous as to endanger the safety of the wheel.

Rule 8. Seams 1 inch long or over at a distance of ½ inch or less from the throat of the flange, or seams 3 or more inches long on any other point of the tread.

Rule 9.—Worn through chill: when the worn spot ex-

ceeds 2½ inches in length. Care must be taken to distinguish this defect from flat spots caused by sliding wheels.

Rule 10. Worn flange: wheels under cars of 80,000 pounds capacity or under, with flanges having flat vertical surfaces extending more than 1 inch from tread, or flange 1 inch thick or less. Wheels under cars of over 80,000 pounds capacity with flanges having flat vertical surfaces extending more than ⅞ inch from tread, or flange less than 1 1-16 inches thick. (See Figs 195 and 196.)

Rule 11. Thick flange: flange over 1 7-16 inches thick. This does not apply to wheels cast prior to September 1, 1894. (See Fig. 193.)

Rule 12. Tread worn hollow: if the tread is worn sufficiently hollow to render the flange or rim liable to breakage.

Rule 13. Burst: if the wheel is cracked from the wheel fit, outward, by pressure from the axle.

Rule 14. Broken flange, caused by seams, worn through chill or worn flange See also Rules 20 and 21.

Rule 15. Broken or chipped rim, caused by defective casting, if the tread, measured from the flange at a point ⅝ inch above tread, is less than 3¾ inches in width. (See Fig. 197.) See also Rules 20 and 21.

Rule 16. Cracked tread, cracked plate, one or more cracked brackets, or broken in pieces under fair usage. See also Rule 20.

Rule 17. Wheels loose or out of gauge. (See Figs. 198 and 199.)

Rule 18. Chipped flange: if chip is on the outside of the flange and exceeds 1½ inches in length and ½ inch in width, or if it extends ⅛ inch past the center of flange.

Delivering Company responsible (Rules 19 and 20):

Rule 19. Flat sliding: if the spot caused by sliding is 2½ inches or over in length. (Care should be taken to distinguish this defect from *worn through chill.*)

Rule 20. Broken flange, except as in Rule 14; chipped flange, if chip is on throat side of flange, and exceeds 1½ inches in length and ½ inch in width, or if it extends ⅛ inch past the center of flange; broken rim, if not caused by defective casting; if the tread, measured from the flange at a point ⅝ inch above tread, is less than 3¾ inches in width (see Fig. 197), or any breakage caused by unfair usage, derailment or accident.

Rule 21. The determination of flat spots, worn flanges and chipped treads shall be made by a gauge as shown in Fig. 192. The determination of thick flanges shall be made by a gauge as shown applied to M. C. B. standard wheel tread and flange in Fig. 193.

The following engravings of the wheel defect gauge (Fig. 192), show the method of using it:

For wheels under cars of 80,000 pounds capacity or under with flanges 1 inch thick or less; over 80,000 pounds capacity with flanges less than 1 1/16 inches thick.

For wheels under cars of 80,000 pounds capacity or under, 1 inch from tread; over 80,000 pounds capacity, 7/8 inch from tread.

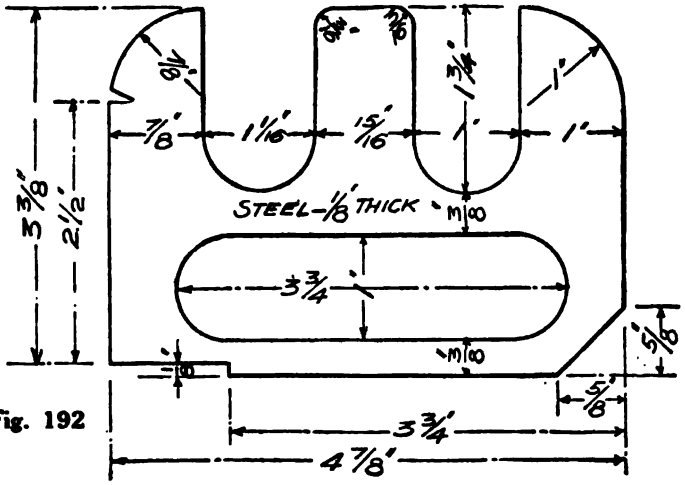


Fig. 192

M. C. B. WHEEL DEFECT GAUGE.

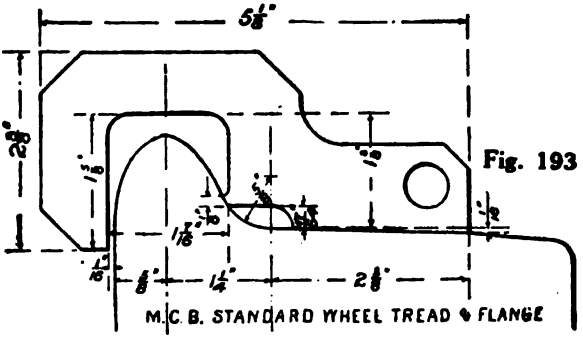


Fig. 193

M. C. B. STANDARD WHEEL TREAD & FLANGE

AXLES.

DEFECTS OF AXLES WHICH JUSTIFY RENEWAL.

Owners responsible (Rules 22 and 23):

Rule 22. Axles broken, or having seamy journals, fillets at the back shoulder worn out, or with collars broken or worn to ¼ inch or less, under fair usage

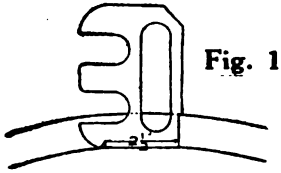
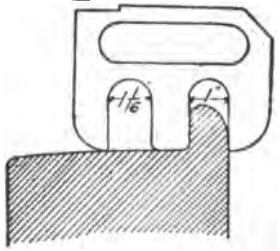


Fig. 194

METHOD OF GAUGING SHELLED AND FLAT SPOTS.

Fig. 195



METHOD OF GAUGING WORN FLANGES.

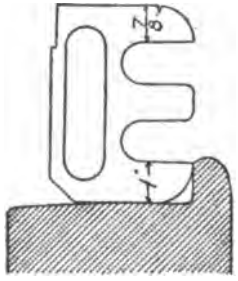


Fig. 196

METHOD OF GAUGING WORN FLANGES.

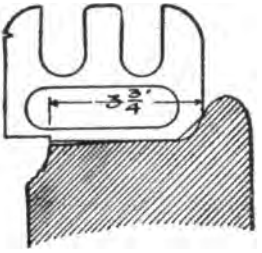


Fig. 197

METHOD OF GAUGING CHIPPED RIMS.

Fig. 198

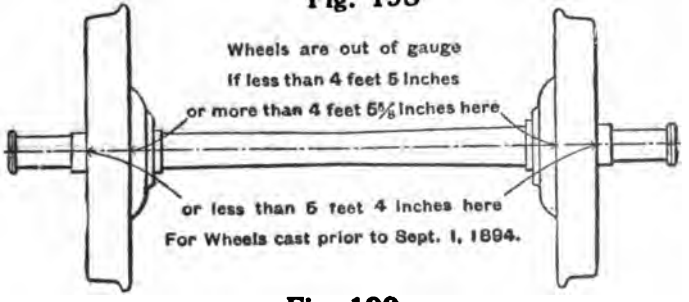
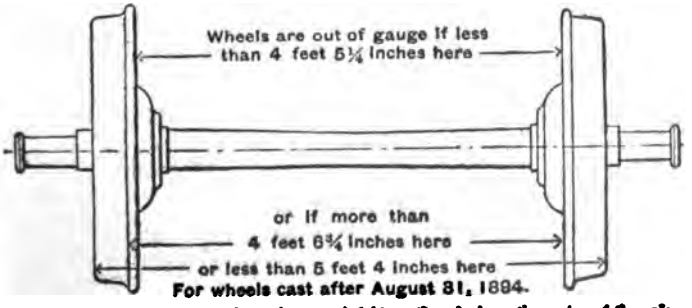

Wheels are out of gauge
If less than 4 feet 5 inches
or more than 4 feet 5⅝ inches here
or less than 5 feet 4 inches here
For Wheels cast prior to Sept. 1, 1894.

Fig. 199


Wheels are out of gauge If less than 4 feet 5¼ inches here
or If more than
4 feet 6¾ inches here
or less than 5 feet 4 inches here
For wheels cast after August 31, 1894.

Measurements to be made at the same height on the wheels as the center of the axle.

Rule 23. Axles less than the following prescribed limits:

Capacity of Car.	Journal.	Wheel Seat.	Center.
100,000	5 inches.	6¾ inches.	5⅞ inches.
80,000	4½ "	6¼ "	5 5-16 "
70,000	4 "	5⅝ "	4⅞ "
60,000	3¾ "	5 "	4⅜ "
50,000	3½ "	4¾ "	4⅛ "
40,000	3¼ "	4⅝ "	3⅞ "
30,000	3 "	4¼ "	3⅝ "
20,000	2¾ "	4¼ "	3½ "

All cars to have their capacity stenciled on them.

Delivering Company responsible (Rule 24):

Rule 24. Cut journals, axles bent or axles rendered unsafe by unfair usage, derailment or accident.

TRUCKS.

DEFECTS OF TRUCKS WHICH JUSTIFY REPAIRS IF OWNERS ARE RESPONSIBLE, OR REPAIRS OR CARDING IF DELIVERING COMPANY IS RESPONSIBLE.

Owners responsible (Rule 25):

Rule 25. Defective, missing or worn-out parts of trucks not elsewhere provided for, which have failed under fair usage, or if any part of the truck frame or attachments is less than 2½ inches above the top of the rail.

Delivering Company responsible (Rules 26, 27, 28):

Rule 26. Damage of any kind to the truck due to unfair usage, derailment or accident.

Rule 27. Material missing from trucks of cars offered in interchange.

Rule 28. Journal bearings and journal box bolts which require renewal by reason of change of wheels or axles for which the delivering company is responsible, regardless of the previous condition of the bearings.

BRAKES.

DEFECTS OF BRAKES WHICH JUSTIFY REPAIRS.

Owners responsible (Rules 29, 30):

Rule 29. Defective, missing or worn out parts of brakes, not elsewhere provided for, which have failed under fair usage, except missing material on cars offered in interchange.

Rule 30. Cylinder or triple valves of air brake cars not cleaned and oiled within twelve months and the date of last cleaning and oiling marked on the brake cylinder with white paint.

Delivering Company responsible (Rules 31, 32, 33):

Rule 31. If 1-inch hose and fittings are found on 1¼-inch train pipe.

Rule 32. Missing or torn air brake hose or missing or broken air brake fittings, angle cocks, cut-out cocks, cylinders and reservoirs, triple valves, release valves, and pressure retaining valves or parts of any of these items.

Rule 33. Damage to any part of the brake apparatus caused by unfair usage, derailment or accident.

Owners responsibility qualified (Rule 34):

Rule 34. If the car has air signal pipes or air brake pipes but no air brakes, the hose and couplings on the car are at owner's risk, unless the car is stenciled that it is so equipped.

BODIES.

DEFECTS OF BODIES WHICH JUSTIFY REPAIRS IF OWNERS ARE RESPONSIBLE, OR REPAIRS OR CARDING IF DELIVERING COMPANY IS RESPONSIBLE.

Owners responsible (Rules 35, 36, 37):

Rule 35. Locks, side doors, end doors, roof doors, grain doors and all inside or concealed parts of cars missing or damaged under fair usage, and failure or loss under fair usage of any part of the body of the car, except as provided for in Rules 39 and 85.

Rule 36. Cars not within the limits of standard height for couplers, 31½ inches to 34½ inches for standard gauge cars.

Rule 37. Steps, ladders, handholes or running boards in bad order or insecurely fastened, or absence of grabirons or handholds as required by law. Handholds or grabirons must be of wrought iron or steel and secured by bolts or lag screws.

Delivering Company responsible (Rules 38, 39, 40, 41, 42, 43):

Rule 38. Damage of any kind to the body of the car due to unfair usage, derailment or accident.

Rule 39. Material missing from body of cars offered in interchange, except locks, side doors, grain doors and all inside or concealed parts of car.

Rule 40. M. C. B. couplers not equipped with steel or wrought iron knuckles.

Rule 41. Cars intended to be equipped with metal brake beams and so stenciled, if found with wooden brake beams.

Rule 42. Cars equipped with M. C. B. couplers having pocket rear end attachments and so stenciled, if found with tail pin attachments instead of pocket.

Rule 43. Uncoupling attachments of M. C. B. couplers offered in interchange must be made operative before moving from interchange points.

IMPROPER REPAIRS.

Company making repairs responsible (Rules 44, 45):

Rule 44. Any company making improper repairs is solely responsible to the owners, with the exception of the cases provided for in Rules 31, 40, 41, 42 and 43.

Rule 45. The company making such improper repairs shall place upon the car, at the time and place that the work is done, an M. C. B. defect card, which card shall state the wrong material used.

COMBINATIONS OF DEFECTS WHICH DENOTE UNFAIR USAGE IF CAUSED AT ONE AND THE SAME TIME AND AT THE SAME END OF CAR.

Rule 46. Damaged coupler, accompanied by damage to either coupler stop, filing block, draft timber or its substitute or end sill.

Rule 47. Damaged coupler pocket, accompanied by damage to either draft timber or its substitute, or end sill.

Rule 48. Damaged coupler stop or filling block, accompanied by damage to either coupler or end sill.

Rule 49. Damaged draft timber or its substitute, accompanied by damage to either coupler, coupler pocket or to end sill.

Rule 50. Damaged wood or iron buffer block, accompanied by damage to end sill.

Rule 51. Damaged end sill, accompanied by damage to either coupler, coupler pocket, coupler stop, filling block, draft timber or its substitute, wood or iron buffer block, or longitudinal sill.

Rule 52. Damaged longitudinal sill, accompanied by damage to end sill.

Rule 53. Damaged longitudinal sills, if necessitating replacement or splicing of more than two sills.

Rule 54. Damaged corner and end posts, if necessitating the replacement of or repairs to more than two end or two corner posts at one end, or more than one end and one corner post at same end of car.

The word "coupler" in the above rules, 46 to 54, inclusive, means the coupler body or knuckle.

INSTRUCTIONS TO REPAIRMEN.

Rule 55. Any car having defects which render it unsafe to run, unsafe to trainmen, or to any lading suitable to the car, may be repaired.

Rule 56. Repairs to foreign cars shall be promptly made, and the work shall conform in detail to the original construction, and with the quality of material originally used, except that malleable iron M. C. B. standards

may be substituted for gray iron M. C. B. standards, and gray iron may be used in place of malleable where gray iron is an M. C. B. standard, provided that in substituting malleable iron for gray iron the price of gray iron is used, and except as provided for in Rules 60 and 61.

Rule 57. In repairing damaged cars M. C. B. standards may be used when of dimensions that do not impair the strength of the cars, in lieu of the parts forming its original construction. When using materials for repairs to foreign cars for which the Master Car Builders' Association has adopted specifications as a standard, the materials must comply with the requirements of these specifications.

Rule 58. In making repairs for which owners are responsible, 30-inch and 36-inch wheels may be replaced with 33-inch wheels, if practicable. If changes are necessary in order to bring the car to the proper height, the cost of so doing shall also be chargeable to the car owner.

Rule 59. Couplers of the vertical plane type other than M. C. B. replaced with M. C. B. standard, the expense of alteration thus necessitated shall be chargeable to car owners.

Rule 60. When M. C. B. couplers of another make are placed upon a car, the uncoupling arrangements shall be made operative at the expense of the company making the repairs.

Rule 61. When M. C. B. couplers, knuckles, metal brake beams, wheels or axles are replaced under conditions which make them chargeable to the owner, it must be plainly stated on the repair card and stub whether the material is new or second hand.

Rule 62. Any company finding cars not within the limits of standard height for couplers may make repairs and charge to owners. Cars should be adjusted in height when empty, as far as possible, and in order to justify a bill for this work under the Rules of Interchange an empty car measuring 32½ inches or less should be adjusted to 34½ inches, or within ¼ inch thereof, and when it is necessary to alter a loaded car it should be adjusted to 33½ inches or within ¼ inch thereof, or as nearly as possible to such height as will bring it to 34½ inches when the car is unloaded, the height to be measured from top of the rails to the center line of the coupler shank.

Rule 63. Center sills or draft timbers must not be spliced. All other sills may be spliced once. When the sills are less than 12 inches in depth the plan shown in Fig. 200 is to be followed:

When the sills are 12 inches or more in depth the plan shown in Fig. 201 is to be followed:

The splice may be located either side of body bolster, but the nearest point of any splice must not be within 12 inches of same. The splicing of two adjacent sills at the same end of the car, or the splicing of any sill between cross-tie timbers, will not be allowed.

Rule 64. Wheels on the same axle must be of the same circumference.

Rule 65. New wheels must not be mated with second hand wheels.

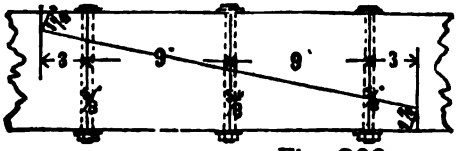


Fig. 200

SPLICING SILLS.

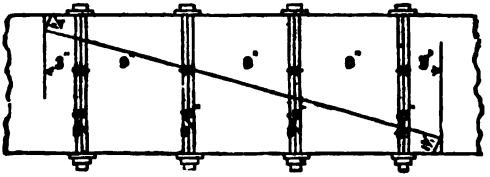


Fig. 201

SPLICING SILLS.

Rule 66. Prick punching or shimming the wheel fit must not be allowed.

Rule 67. The wheel seats of foreign axles must not be reduced more than 1/16 inch to fit the wheels, and in no case must they be reduced below the limits given in Rule 23.

Rule 68. Any company repairing foreign cars with wrong material, and not in compliance with the Rules 55 to 68, inclusive, shall be liable to the owners for the cost of changing such car to the original standard, or to the requirements of these rules, except that companies applying axles smaller than the limits given in Rule 23 shall not be held responsible for improper repairs if the car is not stenciled showing the capacity of the car.

Rule 69. In replacing air brake hose on foreign cars for which bills are made, new hose must be used.

Rule 70. If the weight of a car is found to vary more than 500 pounds from the light weight stenciled on the car, a railroad company having the car in its possession may weigh and restencil the car, making a charge for each car weighed and so reported. The railroad company making the bill shall notify the owner, giving the date and point at which the reweighing was done.

Rule 71. Cars undergoing extraordinary repairs, such as sills, resheathing, roofing, etc., must be reweighed and restenciled by the company having the car in its possession at its own expense, and the owner notified.

Rule 72. When second hand axles are applied under conditions which make them chargeable to the owners, the diameters of journals of such axles applied must not be less than ⅛ inch above the limit dimensions given in Rule 23.

Rule 73. When two or more cars chained together, or any cars which require switch chains to handle them, are delivered at an interchange point, the receiving road shall deliver to the delivering road at the time, an equivalent number of switch chains of the same size as the chains so used on the cars delivered, or, in lieu thereof, furnish a defect card for such chains.

USE OR REPAIR CARD.

Rule 74. When repairs of any kind are made to foreign cars a repair card shall be securely attached to outside face of intermediate sill between cross-tie timbers. This card shall specify fully the repairs made, and reason for same, the date and place where made, and name of road making repairs; also show location of parts repaired or renewed. The end of car on which brake staff is located shall be known as "B" end, and the opposite end as "A" end. Where there are two brake staffs on the car, the end toward which the cylinder push rod travels shall be known as "B" end. The card shall be provided with a stub, which will duplicate information on the card, and stubs must be forwarded with the bill.

If no bill is to be rendered, the repair card stub must be forwarded on or before the twentieth day of each month, with the words "no bill" written across the face of the repair card stub. In case it is not the intention to render bill, the words "no bill" shall be written across the face of the repair card.

Rule 75. The repair card shall be 3½ by 8 inches, and the stub 3½ by 4 inches. The card shall be printed on both sides in black ink, and shall be filled in on both sides with ink or black indelible pencil, and be of the following form:

This stub to be Retained by Person Issuing Card

Master Car Builders' Ass'n Repair Card Stub

C. M. & St. P. R'y. Date 190—

Rep'd at Shop

Inspector

Car No. Initials

When Card is Applied send Stub at once to Supt. Motive Power, West Milwaukee, Wis.

Master Car Builders' Ass'n Repair Card Stub

C. M. & St. P. R'y. Date 190—

Rep'd at Shop

Inspector

Car No. Initials

(over)

Reasons for repairs noted on other side.

Reasons for repairs noted on other side.

FORM-617

Master Car Builders' Ass'n Repair Card

Chicago, Milwaukee & St. Paul R'y Co. Date 190—

REPAIRS MADE	WHY MADE

Rep'd at Shop Inspector

Car No. Initials

Note.—The printing on back of repair card stubs should be the reverse of that shown here.

The cards and stubs must state whether solid or filled journal bearings are applied or removed.

Rule 76. Any road making partial repairs of defects on a car which are covered by defect cards will have the defects repaired crossed off the original card with ink or indelible pencil and card placed back on car. A copy of the card accompanying the bill with the defects which were not repaired crossed off will be sufficient authority to bill.

Rule 77. Duplicate repair cards shall be furnished for lost or illegible cards.

INSTRUCTIONS FOR BILLING.

Rule 78. Bills may be rendered for work done under Rule 55, except in cases where owners are not responsible and the car bears no defect card covering the defects repaired, stating upon the bill the date and place where the repairs were made; the repair card stub or defect card to accompany the bill.

Rule 79. Car owners may require receipt of repair card or stub before payment of bill for repairs.

Rule 80. For repairs made on defect cards, the card must accompany the bill as voucher for the work done, but no bill shall be rendered for repairs which have not been made.

Rule 81. When improper repairs of owner's defects have been made and bill rendered, the owner may counter bill against the company making the wrong repairs for the cost of changing the car to the original standard, or to the requirements of Rules 55 to 77, inclusive, if the work is done.

Rule 82. When improper repairs of defects for which owners are not responsible are made, the owner may make bill against the company making the improper repairs for the cost of changing the car to the original standard, or to the requirements of Rules 55 to 77, inclusive, if the work is done.

Rule 83. The evidence of a joint inspector or the joint evidence of two persons, one representing the owner of the car, and the other representing the delivering road, that the repairs are not proper, shall be final. A joint evidence card shall be used for this purpose, which shall describe and show location of parts repaired or renewed. The end of the car on which the brake staff is located shall be known as "B" end, and the opposite end as "A" end. Where there are two brake staffs on the car, the end toward which the cylinder push rod travels shall be known as "B" end. This card shall be of the following form:

THE.....RAILWAY CO.

Report of Improper Repairs to.....Cars.

Station.....190..

Car No...Initial...Received from.....R'y. At...Date...190..

Description of wrong Repairs	How Repairs should be made
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....

Show how Carded on other Side. ...Inspector for.....R'y.

We Certify Above to be Correct. ...Inspector for.....R'y.

THE.....RAILWAY CO.

M. C. B. Defect Card. Issued by....R'y. At.....Date....190..

Inspector.....Reading as follows.....

.....

.....

.....

.....

.....

M. C. B. Repair Card. Issued by.....R'y. At....Date....190..

Inspector.....Reading as follows.....

.....

.....

.....

.....

Disposition of Car.

Carded to....Shop; Repaired; went forward without Repairs.

Rule 84. The joint evidence card, accompanied by a proper repair card, upon which a bill has been made, shall be used as authority for rendering bill, but if unaccompanied by such repair card, the joint evidence card shall be sent to the company against which the evidence has been presented, and it shall furnish a defect card covering the wrong repairs if it made them.

Rule 85. Bills may be rendered against car owners for the labor only of replacing couplers, brake beams (including their attachments, such as shoes, heads, key bolts, jaws and hangers), brake levers, top and bottom brake rods that have been lost on the line of the company making the repairs. Coupler springs, followers and yokes may be included in the above, providing they have been lost with the couplers.

Rule 86. In making bills under these rules, the information necessary for the car department should be embodied on the following forms, whether the same is made as a bill or a statement to accompany a bill:

.....*Company,*

Address.....

To .....*Railroad Company, Dr.*

For Wheels and Axles put under.....*Cars, Month of*.....*190...*

Date and Place.	Initial, Kind and No. of Car.	Wheels and Axles Removed.					Wheels or Axles Applied.							
		Maker.	Date Cast.	No. on Wheel or Axle.	Cause of Removal.	Shop Marks on Wheels and Axles.	Maker.	Date Cast.	No. on Wheel or Axle.	New or Second Hand.	Shop Marks on Wheels and Axles.	Material Net Charge.	Labor Charge.	Total Net Charge.

Date .....*190...*

Received Payment, $.....

....

STATEMENT OF REPAIRS MADE PER M. C. B. RULES TO.....CARS.

BY_____RAILWAY CO.

DURING.....190.....

Repairs Made		CAR		DESCRIPTION OF PARTS REPAIRED.	Value of Miscellaneous Material.	IRON			BRASS		Chain	Lumber	Spring		Labor	CREDIT FOR SCRAP					
Date	Place	Initials	Number			Cast	Wrot	Mall.	Filled	Solid						Cast	Wrot. and Steel	Mall.	Steel Springs and Chains	Solid Brass	Filled Brass
						Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Feet	Lbs		Hrs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
				QUANTITY.																	
				PRICE,											20c.						
				VALUE,																	

Total,		
Less for Scrap,		
Net charge,		

Rule 87. Bills rendered for wheels and axles shall be in accordance with the following schedule of prices for material, with the proper debits and credits:

	New.	Secondhand.	Scrap.
One 36-inch wheel	$10.00	$7.50	$5.00
One 33-inch wheel	8.50	6.75	4.50
One axle, 100,000 lbs.	24.00	13.50	7.75
One axle, 80,000 lbs.	19.00	11.00	6.50
One axle, 60,000 lbs.	14.00	7.75	5.25
One axle, 50,000 lbs. (or under)	12.00	6.50	4.50

and with an additional charge for all labor for each pair of wheels and axles removed from all arch bar trucks of $1.75, and from all solid pedestal trucks of $2.00. If new wheels and axles are substituted for secondhand wheels and axles, proper charges and credits shall be allowed, although such substitution be made on account of only one loose or defective wheel, or a defective axle, with the following exceptions: In case the owner of a car removes a damaged wheel or axle, no charge shall be made for any difference in value between the parts used and those removed that are not damaged.

Rule 88. If car owner elects on account of improper repairs to remove M. C. B. standard axles suitable to the capacity of the car, he shall make charge for secondhand axles and allow credit for secondhand axles if they are in good order. Axles removed below the journal limit of 100,000 pounds, 80,000 pounds, 60,000 pounds and 40,000 pounds capacity to be credited as scrap when removed.

Rule 89. Bills for wheel and axle work must make specific mention of each axle and wheel removed or applied.

Rule 90. Bills which do not embody all the information called for by the headings of the columns may be declined until made to conform to the requirements of the rule. If no marks are found on wheels or axles removed, a notation to that effect must be made on face of bill.

Rule 91. In noting on bills the cause of removal of wheels and axles, the terms used in Rules 7 to 24, inclusive, shall be used, and the dimensions of the defect or variation from the prescribed limits should be carefully specified.

Rule 92. Bills for repairs made under these rules and for material furnished shall be in conformity with schedules of prices and credits for the articles enumerated below:

Material.	Charge.	Credit.
Air-brake hose, 1¼ inch, complete with fittings applied to car	$2.00	.....
Air-brake hose, 1¼ inch, credit for fittings for same	.....	$ .80
Air-brake hose, 1 inch, complete with fittings applied to car	1.75	.....
Air-brake hose, 1 inch, credit for fittings for same	.....	.80
Angle cock	1.40	.....
Angle cock handle	.08	.....

Material.	Charge.	Credit.
Auxiliary reservoir ..... $	2.45	.....
Bolts, nuts, and forgings, finished .....per lb.	.03	¾c.
Brake shoes applied; no credit for scrap	.30	.....
Brake shoe key, applied; no credit for scrap	.05	.....
Castings, rough iron.....per lb.	.01¾	6-10c.
" " malleable iron ..... "	.03	½c
" " steel ..... "	.04½	¾c.
Chain ..... "	.05	.01
Coupling, dummy	.10	.....
Coupler, M. C. B., complete, new, malleable iron..	7.25	.....
Coupler, M. C. B., complete, new, steel.....	8.25	.....
Coupler body, one, new, malleable iron.....	5.25	.80
Coupler body, one, new, steel.....	6.25	1.05
Coupler knuckle	1.75	.45
Other individual malleable, wrought or steel parts, ... per lb.	.03½	.....
Cut-out cock	1.20	.....
Cut-out cock handle	.08	.....
Cylinder, body (8 by 11 inches)	1.60	.....
" piston and rod	.95	.....
" piston follower	.10	.....
" piston packing leather	.40	.....
" " " " expander	.05	.....
" piston release spring	.50	.....
" non-pressure head	.50	.....
" gasket	.05	.....
Door, for end of box or stock car, wooden, each, applied; no credit for scrap	1.75	.....
Door, for end of box or stock car, ventilated (wooden frame with iron rods), each, applied; no credit for scrap	3.00	.....
Door, for side of box or stock car, wooden, each, applied; no credit for scrap	3.50	.....
Door, for side of box or stock car, ventilated (wooden frame with iron rods), each, applied; no credit for scrap	5.00	.....
Door, for side of stock car, with iron rods, each, applied; no credit for scrap	4.00	.....
Door, for roof of coke car, wooden, each, applied; no credit for scrap	2.25	.....
Door, for roof of stock car, wooden, each applied; no credit for scrap	.75	.....
Gasket, air-hose coupling	.04	.....
Half door, for side of box or stock car, each, applied no credit for scrap	2.50	.....
Hatch cover, for roof of refrigerator car, wooden, each applied; no credit for scrap	1.50	.....
Hatch plug, for refrigerator car, wooden, each, applied; no credit for scrap	1.50	.....
Iron, galvanized .....per lb.	.04	.....
Journal bearings of brass or bronze, lined or unlined, per lb., applied	.16	.11
Journal bearings, filled brass or bronze shell, per lb., applied	.12	.09
The weight charged for new journal bearings for 7 inch journals and over, but not 8 inches long, shall not exceed 10 pounds; the weight charged for new journal bearings for journals 8 inches long and less than 9 inches long shall not exceed 13 pounds; and for new journal bearings 9 inches long or over, but not 10 inches, 20 pounds. The weight charged for new journal bearings for 100,000-pound capacity cars (5½ by 10 inches) shall be 25 pounds. The weight of scrap credited must be one-half the weight of the bearing charged.		
Labor, per hour	.20	.....

Material.	Charge.	Credit.
Lumber—yellow, white and Norway pine, poplar, oak hickory and elm, dressed and framed, per ft. B.M., required to make the part	$ 0.03	.....
Nails per lb.	.03	.....
Paint, lead, freight car, mixed "	.15	.....
Paint, mineral, freight car, mixed "	.05	.....
Pipe, nipple on end of train pipe	.10	.....
Pipe, ⅜-inch, per foot	.03	.....
" 1¼-inch, "	.07	.....
Pressure-retaining valve	1.00	.....
Release valve	.70	.....
Release valve handle	.08	.....
Release rod	.10	.....
Steel for springs, rough per lb.	.04	¾ c.
" helical springs "	.03½	.01
Train pipe air strainer (1¼ inch)	.55	.....
Triple check valve case	.80	.....
Triple cylinder cap (drain cup)	.70	.....
" " " " gasket	.35	.....
" emergency valve	.55	.....
" " " seat	.50	.....
" " " piston	.45	.....
" " " rubber seat	.05	.....
" " check valve	25	.....
" " " spring	.02	.....
" " " case gasket	.08	.....
" graduating spring	.05	.....
" " stem	.15	.....
" " " nut	.25	.....
" " valve	.05	.....
" piston and ring	1.75	.....
" " ring (only)	.25	.....
" slide valve	.90	.....
" " " spring	.05	.....
" valve strainer	.05	.....
" " gasket	.15	.....

Rule 93. Not more than one pound of mineral paint can be charged for 15 square feet of surface covered, and not more than one pound of lead paint for 12 square feet of surface covered. No charge to be made for lettering.

Rule 94. Whenever scrap credits are allowable the weights of scrap credited shall be equal to the weights of the new metal applied, except as otherwise provided in the rules, and except in the case of scrap M. C. B. couplers, and parts of same, and material applied on defect cards, in which cases the weight and kind of metal removed shall be credited.

Rule 95. In the application of channels they should be charged out at the market price plus the necessary labor for drilling, etc.; credit should be at prices quoted above for similar metal.

Rule 96. Bills shall not be rendered for amounts less than 25 cents in aggregate, but charges for items less than 25 cents may be held until they amount to that sum, provided said aggregate is rendered within 60 days. No bill shall be returned for correction on account of error for

less than 100 cents in aggregate of bill, but said bill shall be passed for payment at once, and the alleged error brought to the attention of the road rendering the same within sixty days from date of bill. The receiving road shall at once issue a letter of authority for counter bill to cover the acknowledged error, said letter to be attached to the bill as authority.

No bills shall be returned for correction on account of wrong car numbers, but road rendering bill should be communicated with by letter, and if, after investigation, it is found to be a fact that wrong car number has been given, correct number shall be furnished or credit covering amount of charge allowed on next month's bill.

When necessary to return bills for correction, all defect cards and repair card stubs should be detached except those covering repairs to cars, the charge for which there may be some question as to its correctness.

Rule 97. All offices rendering bill should consolidate all charges against any one company into one monthly bill.

Rule 98. Journal bearings having a lining ⅜-inch thick or thicker, shall be charged as filled journal bearings, and not as lined journal bearings.

Rule 99. In rendering bills for owner's defects, the following should be observed:

No credit for scrap and no charge for labor shall be allowed in renewing brake shoes.

Rule 100. When M. C. B. coupler parts or metal brake beams are replaced, good secondhand material may be used, but they must be charged at seventy-five per cent of the prices when new. The credits for similar parts released from service in good condition must also be seventy-five per cent of the prices when new.

Rule 101. Manufactured articles not included in the above list must be charged at current market prices, without freight charges.

Rule 102. No percentage to be added to either material or labor.

Rule 103. Bills for the following work, to make cars conform to United States laws and to conform to the requirements of Rule 62, must be rendered within 60 days after the work is done, and must state the height of the car before and after altering:

Altering height of one end of one car	$1.00
Putting on one handhold or grabiron	.20

Rule 104. The following table shows the number of hours which may be charged for labor in doing the various items of work enumerated, which includes all work necessary to complete each item of repairs, except in so far as labor is already included in charges for materials:

	Ordinary Cars.		Refrigerator Cars.	
	Hrs.	Charge for Labor.	Hrs.	Charge for Labor.
American continuous draft rods, one rod, welding	1	$0.20	1	$0.20
Arch bars, 1 or 2, replaced on same side of truck	3	.60	3	.60
Arch bar, upper or lower, or both, blacksmith shop labor, repairing	2	.40	2	.40
Axle, bent, straightening	4	.80	4	.80
Bolster, body, composite, one, replaced	10	2.00	12	2.40
Bolster, body, plain metal or wood, one, replaced	8	1.60	10	2.00
Bolster, body, plain metal or wood, one, replaced when one or more defective sills are replaced	2	.40	2	.40
Bolster, composite, one, replaced when one or more defective sills are replaced	4	.80	4	.80
Bolster, truck, one, replaced	10	2.00	10	2.00
Bolster, truck, one, and one spring plank in same truck, replaced	12	2.40	12	2.40
Brakebeam, one, replaced	2	.40	2	.40
Brake beam, one, metal, blacksmith labor repairing	2	.40	2	.40
Buffer blocks, cast-iron, each, replacing	1	.20	1	.20
Buffer blocks, wooden, replacing at one end of car	2	.40	2	.40
Carline, one, replaced	3	.60	..	..
Carrier iron bolts, three or less, at one end of car, applied	2	.40	2	.40
Carrier iron bolts, all at one end of car, applied	3	.60	3	.60
Center pin head applied, empty car	½	.10	½	.10
" " " " loaded "	2	.40	2	.40
Center pin key applied, empty car	1½	.30	1½	.30
Center plate, one, replacing	2	.40	2	.40
Center plates, two, replacing at same end	3	.60	3	.60
Center plate bolts, replacing, in part or all at one end	3	.60	3	.60
Center plate bolt or bolts and center plate replacing on one end of car	3	.60	3	.60
Column bolts, one or more, replaced in same truck	2	.40	2	.40
Corner iron, one, replaced	1	.20	1	.20
Corner post, one, replaced, empty car	3	.60	6	1.20
Corner post, one, replaced, loaded car	4	.80	6	1.20
Coupler stops, all, at one end of car, replaced.	3	.60	3	.60
Coupler stops, one or two, at same end of car, replaced	2	.40	2	.40
Coupler with stem attachments, coupler springs, one or more follower plates, American continuous draft key, American continuous draft rods, one or two coupler stops, renewing or replacing any or all, at same end of car, at same time	2	.40	2	.40
Coupler, with pocket attachments, coupler spring, one or more follower plates, one or two coupler stops, coupler pocket, coupler pocket rivets, renewing or replacing any or all, at same end of car at same time	3	.60	3	.60

	Ordinary Cars.		Refrigerator Cars.	
	Hrs.	Charge for Labor.	Hrs.	Charge for Labor.
Cross-tie timber, one, replaced	3	$0.60	3	$0.60
Cross-tie timber, one, replaced when one or more defective sills are replaced	1	.20	1	.20
Door, end, old, rehanging	½	.10	..	....
Door, side, old, rehanging	1	.20	1	.20
Door post, one, replaced, empty car	3	.60	6	1.20
Door post, one, replaced, loaded car	4	.80	6	1.20
Draft timber, one, replaced	6	1.20	6	1.20
Draft timber, one, replaced when its center sill has been replaced	1	.20	1	.20
Draft timbers, two, on same end, replaced	9	1.80	10	2.00
Draft timber bolts complete, at one end of car, replacing	3	.60	3	.60
Draft timber bolts, three or less at one end of car, replacing	2	.40	2	.40
Draft timber bolts, four or more at one end of car, replacing	3	.60	3	.60
End plank, one, renewed on gondola car—				
without angle irons	2	.40	..	....
with angle irons, bolted	3	.60	..	....
with angle irons, riveted	5	1.00	..	....
End planks, two, renewed on same end—				
without angle irons	2½	.50	..	....
with angle irons, bolted	3½	.70	..	....
with angle irons, riveted	5½	1.10	..	....
End planks, three, renewed on same end—				
without angle irons	3	.60	..	....
with angle irons, bolted	4	.80	..	....
with angle irons, riveted	6	1.20	..	....
End planks, four, renewed on same end—				
without angle irons	3½	.70	..	....
with angle irons, bolted	4½	.90	..	....
with angle irons, riveted	6½	1.30	..	....
End plate, one, replaced	12	2.40	14	2.80
End post, one, replaced, empty car	3	.60	6	1.20
End post, one, replaced, loaded car	4	.80	6	1.20
Journal box, one, replaced	2	.40	2	.40
Journal boxes, two, on same axle, replaced	3	.60	3	.60
Journals, truing up one or two, on same axle	2	.40	2	.40
Platform plank, one, replaced	1	.20	1	.20
Putting car on center, empty	1	.20	1	.20
Putting car on center, loaded	2	.40	2	.40
Releasing rod for M. C. B. coupler, one, replaced	½	.10	½	.10
Running board, complete, applied	6	1.20	6	1.20
Spring plank, one, replaced	10	2.00	10	2.00
Side plank, one, renewed on gondola car—				
without angle irons	4	.80	..	....
with angle irons, bolted	7	1.40	..	....
with angle irons, riveted	8	1.60	..	....
Side planks, two, renewed on same side—				
without angle irons	5½	1.10	..	....
Side planks, two—				
with angle irons, bolted	8	1.60	..	....
with angle irons, riveted	9	1.80	..	....
Side planks, three, renewed on same side—				
without angle irons	7	1.40	..	....
with angle irons, bolted	9	1.80	..	....
with angle irons, riveted	10	2.00	..	....

	Ordinary Cars.		Refrigerator Cars.	
	Hrs.	Charge for Labor.	Hrs.	Charge for Labor.
Side planks, four, renewed on same side—				
without angle irons	8½	$1.70	..	....
with angle irons, bolted	10	2.00	..	....
with angle irons, riveted	11	2.20	..	....
Side plate, one, applied	25	5.00	35	7.00
Side plate, one, spliced	8	1.60	15	3.00
Side post, one, replaced	3	.60	6	1.20
Siding, removed and replaced, per lineal foot	..	.10	..	.10
SILLS:				
1 center sill, replaced	32	6.40	44	8.80
2 center sills, replaced	38	7.60	65	13.00
1 end sill under siding, replaced	15	3.00	15	3.00
1 end sill outside siding, replaced	7	1.40	7	1.40
1 end sill under siding, replaced when one or more defective sills have been replaced	3	.60	3	.60
1 end sill outside siding, replaced when one or more defective sills have been replaced	2	.40	2	.40
1 intermediate sill, replaced	29	5.80	40	8.00
2 " sills, "	35	7.00	56	11.20
3 " " "	41	8.20	66	13.20
4 " " "	47	9.40	76	15.20
1 inter. sill and 1 center sill replaced	38	7.60	60	12.00
1 " " " 2 " sills "	44	8.80	81	16.20
2 " sills " 1 " sill "	43	8.60	70	14.00
2 " " " 2 " sills "	50	10.00	91	18.20
3 " " " 1 " sill "	48	9.60	80	16.00
3 " " " 2 " sills "	60	12.00	101	20.20
4 " " " 1 " sill "	60	12.00	90	18.00
4 " " " 2 " sills "	65	13.00	111	22.00
1 intermediate sill, spliced	11	2.20	14	2.80
1 side sill and 1 center sill replaced	48	9.60	65	13.00
1 " " " 2 " sills "	53	10.60	86	17.20
2 " sills " 1 " sill "	68	13.60	86	17.20
2 " " " 2 " sills "	71	14.20	107	21.40
1 " sill spliced	12	2.40	15	3.00
1 " sill replaced	25	5.00	44	8.80
2 " sills "	40	8.00	65	13.00
1 " sill and 1 inter. sill replaced	44	8.80	60	12.00
1 " " " 2 " sills "	50	10.00	70	14.00
1 " " " 3 " " "	56	11.20	80	16.00
1 " " " 4 " " "	62	12.40	90	18.00
2 " sills " 1 " sill "	58	11.60	81	16.20
2 " " " 2 " sills "	64	12.80	91	18.20
2 " " " 3 " sills "	70	14.00	101	20.20
2 " " " 4 " " "	76	15.20	111	22.20
1 side, 1 inter. and 1 center sill replaced	53	10.60	81	16.20
2 " 1 " " 1 " " "	74	14.80	102	20.40
1 " 2 " " 1 " " "	58	11.60	91	18.20
2 " 2 " " 1 " " "	76	15.20	112	22.40
1 " 3 " " 1 " " "	63	12.60	101	20.20
2 " 3 " " 1 " " "	81	16.20	122	24.40
1 " 4 " " 1 " " "	68	13.60	111	22.20
2 " 4 " " 1 " " "	86	17.20	132	26.40
1 " 1 " " 2 " sills "	58	11.60	102	20.40
2 " 1 " " 2 " " "	76	15.20	123	24.60
1 " 2 " " 2 " " "	63	12.60	112	22.40
1 " 3 " " 2 " " "	69	13.80	122	24.40

	Ordinary Cars.		Refrigerator Cars.	
	Hrs.	Charge for Labor.	Hrs.	Charge for Labor.
1 " 4 " " 2 " " "	74	$14 80	132	$26.40
2 " 2 " " 2 " " "	81	16.20	133	26.60
2 " 3 " " 2 " " "	86	17.20	143	28.60
2 " 4 " " 2 " " "	91	18.20	153	30.60
Each side or inter. sill spliced, when other sills have to be replaced as above.....	6	1.20	2	1.40
An additional charge of 75 cents shall be allowed in replacing intermediate or cente. sills on cars equipped with air brakes.				
Stakes, end, on gondola cars, applied, each.	1½	.30	..	...
Stakes, side, on gondola cars, applied, each.	1½	.30	..	....
Truck spring, one, replaced.....	2	.40	2	.40
Truck transom, one, wood, replaced.....	10	2.00	10	2.00
Truck transoms, two, wood, replaced in same truck	12	2.40	12	2.40
Weighing and re-stenciling car, per Rule 70,	½	.10	½	.10
When necessary to remove load to replace body center plate, bolt or bolts, one or two draft timbers, or draft timber bolts, at one end of car.....	2	.40	2	.40

REPAIRS OF STEEL CARS.

All rivets, 10 cents per rivet, which covers removal and replacing of rivets, including removing, fitting and replacing damaged parts, less straightening or repairing.

Straightening or repairing parts removed from damaged car, 60 cents per 100 pounds.

Straightening or repairing parts not removed from damaged car; also any parts that require straightening, repairing or renewing, not included on rivet basis, 20 cents per hour.

Credit for scrap material removed from cars constructed of pressed or structural steel, ½ cent per pound.

Rule 105. No charge to be made for labor of replacing or applying M. C. B. knuckles, knuckle pins, locking pins, clevises, clevis pins, lift chains, brake shoes or brake-shoe keys, except on the authority of a defect card.

Rule 106. When it is necessary to apply an M. C. B. coupler complete, on account of a broken or missing knuckle, the usual labor charge for replacing a coupler can be made.

Rule 107. No additional labor to be charged for applying center pin or friction rollers when center plate bolts or center plates are renewed on same end of car.

Rule 108. No additional labor to be charged for renewing head blocks or buffer blocks if end sill at same end is renewed or replaced.

Rule 109. No additional labor to be charged for replacing or renewing coupler when one or both draft timbers are replaced or renewed at the same end of car at the same time.

Rule 110. The following table shows the labor charges allowable in cents for the items named in air brake work. The letters "R. & R." mean "removed and replaced":

	Cents.
Air hose, R. & R.	3
Angle cock, R. & R.	6
Angle cock handle, R. & R.	6
Check valve case, spring, gasket, or all, R. & R.	9

DETAILS.	Cents.
Disconnecting union	2
Check valve case (two cap screws)	2
Emergency valve seat	5
Total	9

Coupler, dummy, R. & R. (1 lag screw)	1
Cut-out cock, R. & R.	8

DETAILS.	Cents.
1 union disconnected	2
2 pipe connections	6
Total	8

Cut-out cock handle, R. & R.	3
Cylinder, R. & R.	27

DETAILS.	Cents.
Push rod (1 connecting pin)	2
Clamping piston (1 cap screw)	1
Cylinder head, R. & R. (4 nuts ½ inch, 1 cent each)	4
Disconnecting cylinder from reservoir (7 nuts, ½ inch, 1 cent each)	7
Reclamping cylinder piston (1 cap screw)	1
Removing cylinder from car (6 nuts, ⅝ inch, 2 cents each)	12
Total	27

Cylinder and reservoir, R. & R.	36

DETAILS.	Cents.
Removing push rod (1 connecting pin)	2
Removing cylinder head (4 nuts, ½ inch, 1 cent each)	4
Removing cylinder from car (6 nuts, ⅝ inch, 2 cents each)	12

DETAILS.	Cents.
Removing reservoir from car (2 nuts, ⅝ inch, 2 cents each)	4
Removing release rods (2 spring cotters)	2
Removing release valve	2
Removing two plugs	2
Removing triple (2 nuts, ⅝ inch, 2 cents each)	4
Disconnecting train pipe union	2
Disconnecting retaining pipe unions	2
Total	36

Cylinder and reservoir, tightening when loose (8 nuts, 1 cent each) 8

Cylinder cleaned, oiled, tested and stenciled 20

DETAILS.	Cents.
Removing push rod (1 connecting pin)	2
Clamping piston (1 cap screw)	1
Removing cylinder head (4 nuts, ½ inch, 1 cent each)	4
Cleaning, testing and stenciling	13
Total	20

Cylinder release spring, R. & R. 8

DETAILS.	Cents.
Removing push rod (1 connecting pin)	2
Clamping cylinder piston (1 cap screw)	1
Removing cylinder head (4 nuts, ½ inch, 1 cent each)	4
Reclamping cylinder head (1 cap screw)	1
Total	8

Cylinder gasket, R. & R. 20

DETAILS.	Cents.
Disconnecting triple union	2
Disconnecting retaining pipe union	2
Disconnecting reservoir block (2 nuts, ⅝ inch, 2 cents each)	4
Disconnecting reservoir from cylinder (7 nuts, ½ inch, 1 cent each)	7
Removing push rod (1 connecting pin)	2
Clamping cylinder piston	1
Removing release rods (2 spring cotters)	2
Total	20

Emergency valve piston, R. & R. 9

DETAILS.	Cents.
Disconnecting union	2
Removing check valve case (2 cap screws)	2
Removing emergency valve seat	5
Total	9

Emergency valve seat, R. & R. (see E. V. piston) 9
Emergency valve, rubber seat, R. & R. 8

DETAILS.	Cents.
Disconnecting union	2
Removing check valve case (2 cap screws)	2
Removing riveted pin	3
Removing emergency valve nut	1
Total	8

Cylinder piston packing, R. & R. 11

DETAILS.	Cents.
Removing push rod (1 connecting pin)	2
Clamping cylinder piston (1 cap screw)	1
Removing cylinder head (4 nuts, ½ inch, 1 cent each)	4
Removing leather packing (4 nuts, ½ inch, 1 cent each)	4
Total	11

Cylinder piston, R. & R. 12

DETAILS.	Cents.
Removing push rod (1 connecting pin)	2
Clamping cylinder piston (1 cap screw)	1
Removing cylinder head (4 nuts, ½ inch, 1 cent each)	4
Removing leather packing (4 nuts, ½ inch, 1 cent each)	4
Reclamping cylinder piston (1 cap screw)	1
Total	12

	Cents.
Gasket, coupling, R. & R.	2
Graduating nut, stem, spring or all, R. & R.	2
Oil plugs, R. & R., each	2
Packing leather expander, R. & R. (see cylinder piston)	7
Pipe, train or branch, R. & R., for each connection made	3
Push rod, R. & R. (1 connecting pin)	2
Release valve, R. & R.	4

DETAILS.	Cents.
Disconnecting release rod (2 spring cotters) ..	2
Disconnecting release valve	2
Total	4

Release valve, removed, repaired and replaced (R. & R. 4 cents) 9
Release valve rod, removed, repaired and replaced 2

DETAILS.	Cents.
1 spring cotter	1
Removing staple	1
Total	2

Reservoir, R. & R. 25

DETAILS.	Cents.
Removing from car (2 nuts, ⅝ inch, 2 cents each)	4
Disconnecting from cylinder (7 nuts, ½ inch 1 cent each)	7
Removing release rods (2 spring cotters) ..	2
Removing release valve	2
Removing two plugs	2
Removing triple valve (2 nuts, ⅝ inch, 2 cents each)	4
Disconnecting union	2
Disconnecting union, retaining pipe	2
Total	25

Cents.
Removing cylinder cap (3 nuts, ½ inch, 1 cent each).... 3
Removing slide valve (3 nuts, ½ inch, 1 cent each).... 3
Repairing retaining valve (R. & R., 5 cents) 10
Retaining valve, R. & R. (2 lag screws 2 cents, valve, 3 cents) 5
Slide valve, removed, ground in and replaced 33
Slide valve spring, R. & R. 6

DETAILS.	Cents.
Cylinder cap (3 cap screws)	3
Removing riveted pin	3
Total	6

Strainer, R. & R. (disconnecting union) 2
Triple cylinder cap, R. & R. (3 nuts, ½ inch, 1 cent each) 3

	Cents.
Triple cylinder cap gasket, R. & R. (3 nuts, ½ inch, 1 cent each)	3
Triple piston packing ring, fitted	15
Triple valve, removed, cleaned, oiled, tested and stenciled	24

DETAILS.	Cents.
Train pipe union disconnected	2
Retaining pipe union disconnected	2
Removing triple (2 nuts, ⅝ inch, 2 cents each)	4
Check valve case (2 cap screws)	2
Emergency valve seat	5
Cylinder cap (3 bolts)	3
Cleaning, testing and stenciling	6
Total	24

	Cents.
Triple valve gasket, R. & R.	8

DETAILS.	Cents.
Disconnecting branch pipe union	2
Disconnecting retaining pipe union	2
Removing triple (2 nuts, ⅝ inch, 2 cents each)	4
Total	8

Unions disconnected and connected	2

The following basic units were used in determining the details of prices given above. These units are not to be used in rendering bills, but may be used in the determination of cost of other combinations of air brake repairs not above mentioned.

	Cents.
Cap screws or studs or bolts, R. & R., each	1
Cylinder cleaning, testing and stenciling	13
Emergency valve seat, R. & R.	5
Graduating stem nut, R. & R.	2
Lag or wood screws, R. & R., each	1
Nuts tightened when loose, each	1
Nuts, ½ inch or less, R. & R., 1 or 2 on same bolt	1
Nuts, ⅝ inch or over, R. & R., 1 or 2 on same bolt	2
Pins connecting R. & R. (including split key)	2
Pins riveted, R. & R., each	3
Plugs, oil, R. & R., each	1
Spring cotters, R. & R., each	1
Staples, R. & R., each	1
Testing air (after repairs)	5
Threads on pipe, cutting, per coupling	5

	Cents.
Train or branch pipe, disconnected and connected, or only connected, each connection	3
Triple valve, cleaning, testing and stenciling	6
Union disconnected and connected	2

Rule 111. The settlement prices of new eight-wheel cars shall be as follows, with an addition of $27.50 for each car equipped with air brakes. The road destroying a car with air brakes may elect to return the air brake apparatus, including such attachments as are usually furnished by the air brake manufacturer, complete and in good condition:

BODIES.

Wood or Iron.

Box car, eight-wheel, 40 feet long or over	$440.00
Box car, eight-wheel, 36 feet long or over, but under 40 feet	385.00
Box car, eight-wheel, 34 feet long or over, but under 36 feet long	360.00
Box car, eight-wheel, 32 feet long or over, but under 34 feet long	330.00
Box car, eight-wheel, under 32 feet long	265.00
Box car, ventilated, eight-wheel, 40 feet long or over	470.00
Box car, ventilated, eight-wheel, 36 feet long, but under 40 feet	415.00
Box car, ventilated, eight-wheel, 34 feet long, but under 36 feet	385.00
Flat car, eight-wheel, plain, 40 feet long or over	200.00
Flat car, eight-wheel, plain, 32 feet long or over, but under 40 feet	155.00
Flat car, eight-wheel, plain, under 32 feet long	110.00
Gondola car, eight-wheel, drop-bottom, 40 tons capacity or over	330.00
Gondola car, eight-wheel, drop-bottom, 30 tons capacity or over, but under 40 tons	300.00
Gondola car, eight-wheel, drop-bottom, 25 tons capacity or over, but under 30 tons	275.00
Gondola car, eight-wheel, drop-bottom, 20 tons capacity or under	200.00
Gondola car, eight-wheel, hopper-bottom, 50 tons capacity	440.00
Gondola car, eight-wheel, hopper-bottom, 40 tons capacity or over, but under 50 tons	360.00
Gondola car, eight-wheel, hopper-bottom, 30 tons capacity or over, but under 40 tons	330.00
Gondola car, eight-wheel, hopper-bottom, 25 tons capacity or over, but under 30 tons	290.00

Gondola car, eight-wheel, hopper-bottom, 20 tons capacity or less $220.00
Gondola car, eight-wheel, plain, 50 tons capacity and over 350.00
Gondola car, eight-wheel plain, 40 tons capacity, but under 50 tons 300.00
Gondola car, eight-wheel, plain, 30 tons capacity, but under 40 tons 275.00
Gondola car, eight-wheel, plain, 25 tons capacity, but under 30 tons 250.00
Gondola car, eight-wheel, plain, under 25 tons 140.00
Stock car, eight-wheel, 34 feet long or over 330.00
Stock car, eight-wheel, 32 feet long or over, but under 34 feet 300.00
Stock car, eight-wheel, under 32 feet long 265.00

The lengths of cars above mentioned refer to the lengths over the end sills.

In the case of double-deck stock cars, $25.00 may be added to the prices given above for stock cars.

When cars of 60,000 pounds capacity or over and so stenciled, have trucks with journals 4 inches or over in diameter when new, $40 per car shall be added to the figure as given above for the values of car bodies, when equipped with metal bolsters.

When cars are equipped with metal center sills, $35 shall be added to the values of bodies for cost of such metal sills.

STEEL.

Box car, wooden body, metal underframe, eight-wheel, 50 tons capacity, 38 feet 6 inches over end sills.... $750.00
Box car, wooden body, metal underframe, eight-wheel, 36 feet long, but under 40 feet..... 675.00
Flat car, wooden floor, metal underframe, eight-wheel, 50 tons capacity, 40 feet over end sills..... 700.00
Flat car, wooden floor, metal underframe, eight-wheel, 40 tons capacity, 40 feet over end sills..... 540.00
Gondola car, all metal, eight-wheel, hopper bottom, 50 tons capacity, 33 feet over end sills..... 750.00
Gondola car, all metal, eight-wheel, drop bottom, 50 tons capacity, 40 feet over end sills..... 740.00
Gondola car, all metal. eight-wheel, plain, 50 tons capacity, 40 feet over end sills..... 720.00
Gondola car, wooden body, metal underframe, eight-wheel, flat bottom, 40 feet over end sills..... 720.00

TRUCKS.

50,000 lbs. capacity, with metal transoms and wooden bolster, per pair..... $195.00

60,000 lbs. capacity or under, with wooden bolster, per pair $195.00
60,000 lbs. capacity or under, all metal, per pair..... 285.00
80,000 lbs. capacity or under, but over 60,000 lbs., all metal, per pair..... 360.00
100,000 lbs. capacity or under, but over 80,000 lbs., all metal, per pair..... 385.00

Prices include brake beams complete, truck levers, dead lever guides and bottom connection rods.

FOUR-WHEEL CARS.

Coal Car, ordinary, complete..... $220.00
Box car, complete 255.00
Gondola car, drop-bottom, complete..... 330.00

Rule 112. In the case of wooden cars, the depreciation due to age shall be estimated at six per cent per annum upon the yearly depreciated value of the bodies and trucks only. In the case of all steel cars and cars with steel underframes, the depreciation shall be 5 per cent per annum for the bodies of all steel cars; for bodies of cars with steel underframes the depreciation shall be at the rate of 6 per cent per annum with the exception of flat cars with wooden floors, which shall be 5 per cent per annum. The depreciation on the value of trucks of steel cars shall be 6 per cent per annum. Allowances for depreciation shall in no case exceed 60 per cent of the value new. The amount $27.50 for air brakes shall not be subject to any depreciation.

Rule 113. The bodies of refrigerator cars, special stock cars, tank cars, except the tanks, and other freight cars, designed for special purposes, not referred to above, shall be settled for at the present cost price, as may be agreed to by the parties in interest, less the deduction for depreciation due to age, which shall be on the same basis as for regular freight equipment.

Rule 114. In rendering bills, cars shall be treated as belonging to companies or individuals whose name or initials they bear, except in case of Line Cars where the equipment list of the general officers of the Line designates a party to make settlement.

Rule 115. Switching roads will only be allowed to render bills against car owners for the following defects repaired by them: Roof lost on account of decay or faulty construction, worn-out brasses, broken truck springs, truck transoms, arch bars, draft-timber bolts, column bolts, truck hangers, truck transom truss rods, truck bolsters, truck bolster truss rods, oil boxes, spring planks, truck hanger pins, side bear-

ings and center plates, center-plate bolts, center pins, followers, American continuous rods or keys, draft springs, couplers, knuckles and drawbar pockets and rivets, defective wheels as specified in Rules 7 to 18, inclusive, defective axles as described in Rules 22 and 23, cars not within the limits of standard height for couplers, as per Rule 36, safety appliances as prescribed by Rule 37, and grain doors and all inside or concealed parts of bodies of cars missing or damaged under fair usage as prescribed in Rule 35, provided the damage has not been caused by derailment or rough usage. They will be allowed to render bills direct against car owners on all car owners' defects on cars received by them from a railroad company, provided they procure joint evidence from the delivering road that such car owners' defect existed when the car was delivered by the railroad company, joint evidence to accompany the bill against the car owner.

Rule 116. A switching road is a corporation doing the major part of its business on a switching charge.

Rule 117. Bills may be rendered against car owners for the cost of applying temporary running boards and hand rails to make cars safe for trainmen.

DESTROYED CARS AND THE RETURN OF TRUCKS.

Rule 118. The company on whose line the bodies or trucks are destroyed shall report the fact to the owner immediately after their destruction, and shall have its option whether to rebuild or settle for the same.

Rule 119. If the company on whose lines the car is destroyed elects to rebuild either body or trucks, or both, the original plan of construction must be followed, and the original kind and qualities of materials used. The rebuilding must be completed within 60 days from the original date of damage or destruction. In such cases no allowance shall be made for betterments.

Rule 120. If only the body of a car is destroyed, and the company destroying it elects to return the trucks, they shall be put in good order, or accompanied by a defect card, covering all defects or improper repairs made by them for which owners are not responsible, and forwarded, within 60 days, free of freight or other charges, to the nearest point on the line of the company owning or operating the car, and the number, line and class of car destroyed shall be stenciled or painted on each truck so returned.

Rule 121. The company on whose line the body or trucks of a car are seriously damaged, but not destroyed, may notify the owner and ask an appraisement on the damage done to the car as a basis for the disposal of the damaged car.

Rule 122. For the mutual advantage of railway companies interested, the settlement for a car owned or controlled by a railway company, when damaged or destroyed upon a private track, shall be assumed by the railway company delivering the car upon such tracks.

SENDING HOME WORN-OUT AND DAMAGED CARS.

Rule 123. A car unsafe to load on account of general worn-out condition, due to age or decay, shall be reported to its owner, who must be advised of all existing defects. If the owner elects to have it sent home, he shall furnish two home cards, noting upon them existing defects and the route over which the car is to be returned to its owner. If the route coincides with that over which the car passed to the point where it became unserviceable, no liability shall be incurred as between the owner and the road handling the car, either for freight charges in handling the car or for car service during this movement.

Such cards shall be attached to each side of the body of the car. They shall be 3½ by 8 inches, and of the form shown below. They shall be printed on both sides, and shall be filled in on both sides with ink or black indelible pencil:

FROM

..... R. R.

TO

..... R. R.

VIA

.....

.....

Car No..... Initials.....

To be shopped for.....

.....

.....

.....

(Head of Car Department.)

Rule 124. A car which is safe to run, but unsafe to load on account of serious damage caused by wreck or accident, shall be reported to the owners for appraisement and disposition, and disposed of as provided in Rule 123, if the owner so elects.

Rule 125. In case of cars of private ownership sent home on account of general worn-out condition due to age or decay, such cars shall be entitled to as many miles of homeward movement free of charge to owners, as they may have been handled over said line under load, and no mileage to be paid to owners by roads handling. If the haul necessary to get cars home is in excess of such loaded mileage, said excess will be billed against the owner at regular freight rates and the owner notified.

Rule 126. Private line cars sent home to owners on account of being wrecked or damaged in accident shall be regularly billed home free of charge to owners and owners notified, providing such homeward movement passes over roads which have handled the cars loaded, previous to their homeward empty movement; otherwise the damaged cars to travel home empty, free of charges and free of mileage according to home route; or, if owners prefer to have them billed home via direct line, then charges to accrue to such line over which cars were not entitled to free movement.

Furnishing Materials.

Rule 127. Companies shall promptly furnish to each other, upon requisition, and forward free over their own road, material for repairs of their cars injured upon foreign lines that can not be procured in open market. Requisition for such material shall state that it is for repairs of cars, and shall give the number and lettering of such cars and pattern number of castings required when possible.

Conditions of Acceptance of this Code.

Rule 128. Any car owner or railway company may become a party to this Code of Rules by giving notice through one of its general officers to the Secretary of the Master Car Builders' Association.

Railroad companies becoming subscribers to this Code of Rules must have a representative member in the Master Car Builders' Association.

Rule 129. Any car owner or railway company that is a party to this Code of Rules shall be bound by same through its successive revisions, until one of its general officers files with the Secretary of the Master Car Builders' Association its notification of withdrawal.

Rule 130. Acceptance or rejection of this Code of Rules

must be as a whole, and no exception to an individual rule or rules shall be valid.

SETTLEMENT OF DISPUTES.

Rule 131. In order to settle disputes arising under the rules, and to facilitate the revision of the rules at the annual conventions of the Association, an Arbitration Committee of five representative members shall be appointed annually by the Executive Committee; three members of this committee to constitute a quorum.

In case of any dispute or question arising under the rules between the subscribers to said rules, the same may be submitted to this committee through the secretary, in abstract, jointly, said abstract setting forth the point or points at issue, and each party's interpretation of the rules upon which its claim is based, clearly and concisely, not exceeding three typewritten pages of letter size, single space, which shall be signed by both parties to the dispute. Should one of the parties refuse or fail to furnish the necessary information, the committee shall use its judgment as to whether, with the information furnished, it can properly give its opinion. The decisions of the committee shall be final and binding upon the parties concerned. This committee shall report its decisions to the Association, and its report shall be incorporated in the annual report of proceedings of the Association.

REVISION OF THIS CODE OF RULES.

Rule 132. The Arbitration Committee shall ask for suggestions of changes, amendments and additions to these rules prior to each annual convention, which it shall consider, and it shall report its recommendations to the succeeding annual convention.

Rule 133. In the revision of these rules by the Association, a two-thirds vote shall be necessary for adoption.

Rule 134. Voting powers shall be the same as prescribed in the Constitution of the Master Car Builders' Association on matters pertaining to the adoption of standards and the expenditure of money.

Rule 135. This Code of Rules shall be introduced for the discussion and revision at one session of the Master Car Builders' Association cenvention each year.

Rule 136. This Code of Rules shall take effect.....

FOR PASSENGER EQUIPMENT CARS.

1. Each railway company shall give to foreign cars, while on its line, the same care and attention that it gives

its own cars, except in case of cars on which work is done under special agreement existing between the company owning the cars and the road operating the same.

2. Railroad companies handling cars are responsible for damage to any car by unfair usage, derailment or accident, and for improper repairs made by them, and they should make proper repairs at their own expense or issue defect card covering all such damage or improper repairs.

3. Cars must be delivered in good running order, and returned in as good general condition as when received.

4. The receiving road is authorized to make such alterations and repairs as are necessary for the safe movement of cars over its line, and must immediately notify the delivering road of all such alterations and repairs, upon receipt of which notification the delivering road shall furnish proper authority to render bill for such alterations and repairs.

5. Authority must be furnished for the replacement of wheels and axles if in the following condition:

WHEELS.

(*a*) Loose wheels.

(*b*) Variation from gauge beyond the limits as prescribed in the Rules of Interchange for freight cars.

WHEELS, CAST-IRON.

(*a*) Shelled out, with treads defective on account of circular pieces shelling out, leaving round, flat spots, deepest at the edges, with raised centers, if 1¼ inches or more in diameter.

(*b*) Tread worn hollow; if tread is worn sufficiently hollow to render flange or rim liable to breakage.

(*c*) Worn flange; flanges having flat, vertical surfaces, extending more than ¾ inch from tread.

(*d*) Flat spots; if flat spots, caused by sliding, exceed 1¼ inches in length.

(*e*) Burst; if wheels are cracked from the wheel fit outward by pressure from the axle.

(*f*) Flanges, rim, tread, plate or brackets, either cracked, chipped or broken in any manner.

WHEELS, STEEL-TIRED.

(*a*) Loose, broken or cracked hubs, plates, bolts, retaining ring or tire.

(*b*) Worn flange or tire; with flanges less than ¾ inch thick, or having flat, vertical surfaces extending more than

¾ inch from tread, or with tire thinner than shown in Fig. 202.

(*c*) Flat spots; if flat spots, caused by sliding, exceed 1¼ inches in length.

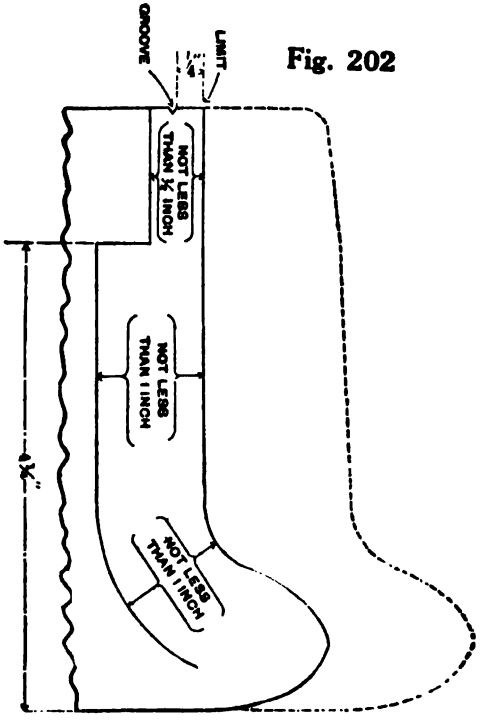


Fig. 202

WORN FLANGE OR TIRE.

AXLES.

Axles bent or broken, or having journals cut or less than 3½ inches in diameter.

BRAKES.

6. Brakes must be in perfect working order. Cylinders must have been cleaned and oiled within six months and

the date of the last cleaning and oiling marked on brake cylinder and triple valve with white paint.

The adjustment of piston travel based on seventy pounds as the initial pressure, must not be less than 5 inches nor more than 8 inches.

BILLS.

7. Bills for wheels and axles shall be of the following form, and must make specific mention of each wheel and axle removed or applied:

	New.	Second-hand.	Scrap.
1 36-inch Cast Wheel	$10.00	$7.50	$5.00
1 33-inch Cast Wheel	8.50	6.75	4.50
1 axle, 60,000 lbs	14.00	7.75	5.25
1 axle, 40,000 lbs	12.00	6.50	4.50

8. Bills rendered for labor and material furnished shall be in accordance with the following prices, with the proper debits and credits:

		New.	Credit for Scrap.
Journal Bearings	per lb.	16 cents.	11 cents.
Malleable Iron	"	3 "	½ "
Bolts, Nuts, Wrought Washers and all Wrought Iron except Axles	"	3 "	¾ "
Castings	"	1¾ "	6-10 "
Spring Steel (not Springs)	"	4 "	¾ "
Lumber: Oak, Pine, Poplar, Hickory and Elm	per ft.	2½ "	
Labor		25c per hour.	

All steel castings and steel wheels of the different makes to be charged at current market prices.

Removing, turning and replacing a pair of steel-tired wheels, $7.

Removing and replacing a pair of wheels, $2.

Loss of service metal from steel-tired wheels as a result of slid spots or other causes, to be charged at the rate of $2 per 1-16 inch thickness of tire.

Glass, paints and other materials to be charged at current market prices.

GAS.

Debits and credits for gas shall be settled on the following basis:

Gas shall be charged at its current market price. No labor shall be charged for filling tanks.

If a car is transferred from the service of one railroad to that of another, the receiving road shall issue an M. C. B. defect card authorizing the delivering road to bill against it for the quantity of gas in the holders at the time car was received.

Cars in interchange requiring holders to be filled, the receiving road shall be charged for the quantity of gas supplied.

For cars stored in shop for repairs, the company having the car in its possession shall be responsible to the delivering company for the gas in the holders. This will apply to sleeping car companies when cars are in their possession and out of service.

CHAPTER XIII.

LOADING AND UNLOADING CARS.

Loading.—A prime factor in the advance made in the art of transportation is the ever increasing ability of carriers to transport larger and bulkier loads. That they have been able to do this has not been dependent alone on the increased effectiveness of motive power, added substantiality of the roadway and track, or the greater capacity of the car itself, but in some measure to greater skill in utilizing the capacity of car equipment to the utmost. It is probable that much yet remains to be done in this direction and that this feature of railroad administration will find a fruitful field for future economies.*

One feature connected with the use of freight cars is that relating to the loading and unloading of the same. This has received the keen scrutiny and intelligent action of railway managers.‡

The question of loading freight cars may be appropriately treated in this volume because there are certain classes of freight of great bulk or weight such as long lumber, logs, telegraph poles, piling, props, tan bark, ties, fence posts, long structural material, plates, rails, girders, turn-

*The question of handling cars and the means that are taken by railroads to utilize them to the utmost is very fully elucidated in another part of this volume.

‡This subject is also discussed in another volume of "The Science of Railways."

tables, pipe, stone, etc., which should be loaded with a view of placing the strain properly on the vehicle. In many cases the load is too long for a single car, the length of the material requiring two or more vehicles for its accommodation. In such cases provision must be made for passing around curves, etc. Much of this kind of freight must also, from its character, be carried on open cars, and further it is essential that safeguards be observed to prevent the load from shifting or any part of it from falling off the car en route, thus menacing the track and the safety of trains. This phase of the subject has been most carefully treated from time to time by the Master Car Builders' Association which has formulated detailed rules, as recommended practice, on the subject. These rules are intended to be uniformly enforced by all railroad companies and are, in general scope at least, necessary for the safe operation of trains and the protection of lives of operatives and passengers. They are as follows:

RULES FOR LOADING LONG MATERIALS ON OPEN CARS.

GENERAL INSTRUCTIONS.

1. The rules here given cover only the more common forms of lading. Where it is found they do not apply, special instructions must be asked for.

2. Cars to be used for shipments of this character must be carefully examined, ALL DEFECTS REMEDIED, and should be properly cambered by drawing up the truss rods.

3. Where maximum weights of lading are not specified, the usual excess of ten per cent will be allowed.

4. All single cars must be so loaded that one HAND BRAKE IS ACCESSIBLE AND OPERATIVE. There must be a clearance of at least six (6) inches between the brake wheel and lading as per Fig. 203.

5. Cars must have sufficient side bearing clearance to allow trucks to curve freely. The maximum side bearing clearance of loaded cars must not be more than three-eighths

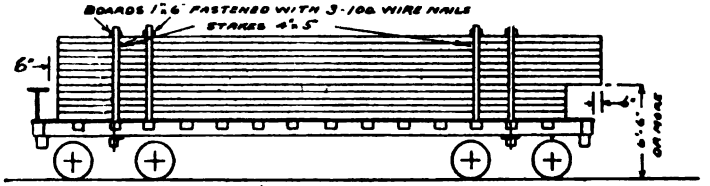
(⅜) inch, for loads less than ten (10) feet high from top of rail, and must not exceed one-fourth (¼) inch for loads ten (10) feet high, or over, from top of rail.

6. The height and width of lading must be governed by the clearance limits of the roads over which the lading is to pass.

7. Lading will not be accepted if placed on top of box or stock cars; or if placed on top of sides of gondola cars having steel sides, or wooden sides less than three (3) inches thick, or wooden sides more than forty (40) inches high.

8. No truck of any car will be allowed to carry more load than ONE-HALF OF THE MARKED CAPACITY OF CAR, PLUS TEN PER CENT, for overload. In case of doubt, this must be verified by weighing.

Fig. 203


BOARDS 1" x 6" FASTENED WITH 3-10d WIRE NAILS
STAKES 4" x 5"
6"
6'-6" OR MORE
LIMITS OF
PROJECTION OF LADING ON SINGLE CAR WHICH DOES
NOT REQUIRE THE USE OF AN IDLER

9. Lading on single cars must never project over end sill of car, unless such overhang is protected by an idler or carrying car forming part of a group of cars, except when this projection is six (6) feet six (6) inches or more above top of rail and does not overhang end sill more than six (6) inches, as per Fig. 203.

10. An IDLER must be used to protect the overhanging load on another car when the load projects over end sill at a height less than six (6) feet six (6) inches from top of rail, or when the load projects more than six (6) inches at a height of more than six (6) feet six (6) inches from top of rail. The idler forms part of the shipment, and must not be detached, during transit, from the loaded car, except for cause, when it must be replaced by another car serving the same purpose and governed by the same restrictions.

11. The WIDTH OF OVERHANGING LOAD, placed on single cars, must never exceed the following dimensions:

Length of Overhang.	Width of Load.	Length of Overhang.	Width of Load.
C	W	C	W
9 ft. — in.	9 ft. 5 in.	15 ft — in.	8 ft. 7 in.
10 " 6 "	9 " 2½ "	16 " 6 "	8 " 4 "
12 " — "	9 " — "	18 " — "	8 " 1 "
13 " 6 "	8 " 9½ "		

The overhang is measured from center of truck to extreme end of overhang.

12. All stakes, clamping pieces, bearing pieces and braces must be sound, straight grained lumber (hardwood preferred), and free from knots that would materially impair their strength. (Hemlock must never be used.) Care must be taken to keep the stakes from spreading at the top while cars are being loaded, and in no case must the load exceed the width of the car. Unless otherwise specified, stakes must not be less than four (4) inches wide by five (5) inches deep, or saplings five (5) inches diameter at the center, tapered at the ends to accurately fit, extend through and completely fill the stake pockets, which should not be less than three and one-half (3½) inches wide by five (5) inches deep.

13. Opposite stakes must always be fastened together. When the specified fastening is by means of boards, there must be two boards for every pair of stakes, each board not less than one (1) by six (6) inches in section, unless otherwise specified, and fastened at each end by not less than three ten-penny wire nails. (Hemlock must never be used.) When the specified fastening is by means of wire, the wire used, unless otherwise specified, must be equal to six strands or three wrappings of No. 8 telegraph wire (or wire of equal strength), and the wire must be secured to prevent it from slipping.

14. Whenever cars are offered in INTERCHANGE and STAKES are not placed according to detail instructions, additional stake pockets may be applied by the receiving road and the cost of same charged to the delivering road.

15. The WEIGHT OF LADING carried on any car must be governed not only by the marked capacity of the car, but also by its general construction, as well as by the number and location of the bearing pieces upon which the load rests.

To prevent overloading, the following regulations must be adhered to:

(a) For loads carried on one bearing piece per car located near the center of car: On flat cars having only two truss rods the weight of lading must not exceed one-half of the marked capacity of car. On flat car having more than two truss rods, and on low-sided gondola cars, the weight of lading must not exceed two-thirds of the marked capacity of car.

(b) For loads carried on one bearing piece per car located about equal distance from center of car and center of truck: On flat cars not exceeding thirty-four (34) feet in length and having only two truss rods the weight of lading must not exceed two-thirds the marked capacity of car; on flat cars more than thirty-four (34) feet in length having only two truss rods the weight of lading must not exceed one-half the marked capacity of car. On flat cars having more than two truss rods, and on low-sided gondola cars, the weight of lading must not exceed three-fourths of the marked capacity of car.

(c) For loads carried on one bearing piece per car, located at or near center of truck, or on top of gondola cars with sides not more than thirty (30) inches high and not less than three (3) inches thick, the weight of lading must not exceed one-half of the marked capacity of the car; or on top of gondola cars with sides not more than forty (40) inches high or less than three (3) inches thick, the weight of lading must not exceed one fourth the marked capacity of the car.

(d) For twin loads of long flexible plates carried on two or more bearing pieces on each car, the weight of lading on any car must not exceed one-half of the marked capacity of the car.

(e) For loads carried on one bearing piece on steel cars, or cars having steel underframe, the cars should be treated the same as those of wooden construction having more than two truss rods.

(f) For loads carried on three bearing pieces on each car, the weight of load so carried must not exceed one-half of the marked capacity of car; but short material may be carried in addition on the floor of the car, provided the total weight of the load does not exceed three-fourths of the marked capacity of the car.

(g) Cars having drop ends shall not be loaded on top of sides unless corner stakes have been suitably reinforced.

The only exceptions are for cars which have been specially prepared for the shipment of particular forms of material.

LOADS TOO LONG FOR SINGLE CARS.

16. The CONSIGNEE AND DESTINATION of all the material on a group of cars must be the same.

17. The lading must always be kept CLEAR OF THE FLOOR OF THE CARS, both carrying cars and idlers. The amount of this clearance must not be less than four (4) inches.

18. A group of cars must have not less than one accessible and operative hand brake for two cars, or two hand brakes for three or five cars.

19. All CARRYING CARS must be considered of the same capacity as the one of lesser capacity.

20. Flat cars must always be used when the load rests partly on one car and partly on another car, except where special provision is made for other types of cars.

21. Where the LADING PROJECTS over end sill, necessitating the use of an IDLER, and there is sufficient material in one consignment, another car may be loaded in reverse order and one idler serve for both cars. The space between the projecting ends of loads may be utilized to load the idlers with short material, but, in all cases, there must be a space of at least two (2) feet between the ends of such ladings.

22. Where the dimensions of BEARING-PIECES are not otherwise specified they must be not less than four (4) inches wide, and of sufficient thickness to keep the lading at least four (4) inches from the floor or end gates of carrying car and idler, and must extend the full width of car. Bearing-pieces more than five (5) inches high may be built up of lumber of ample strength or take the shape of cribbing, the base to be not less than the height. These bearing-pieces must be securely fastened to the floor, as provided for in paragraph No. 72.

23. BEARING-PIECES must never be placed between bolster and end of car, unless special provision is made therefor in detail instructions. When there is but one bearing-piece on a car, it must be placed at least twelve (12) inches from center of bolster toward center of car.

24. The distance between bearing-pieces of ladings on two or more cars should be seven-tenths (7-10) of the total length of lading.

25. The width of long loads must never exceed the following dimensions for the given distance between bearing-pieces or length of overhang when load does not exceed twelve (12) feet in height, measured from top of rail. For loads of greater height, subtract two (2) inches from given width (W) of load for every inch of height in excess of twelve (12) feet.

Distance between bearing-pieces.	Length of overhang.	Width of load.
D	C	W
35′ —″	7′ 6″	9′ 6″
38′ 6″	8′ 3″	9′ 4″
42′ —″	9′ —″	9′ 1¾″
45′ 6″	9′ 9″	8′ 11¼″
49′ —″	10′ 6″	8′ 8½″
52′ 6″	11′ 3″	8′ 5½″
56′ —″	12′ —″	8′ 2½″
59′ 6″	12′ 9″	7′ 11¼″
63′ —″	13′ 6″	7′ 7¾″
66′ 6″	14′ 3″	7′ 4″
70′ —″	15′ —″	7′ —″
73′ 6″	15′ 9″	6′ 7¾″
77′ —″	16′ 6″	6′ 3½″
80′ 6″	17′ 3″	5′ 11″
84′ —″	18′ —″	5′ 6½″

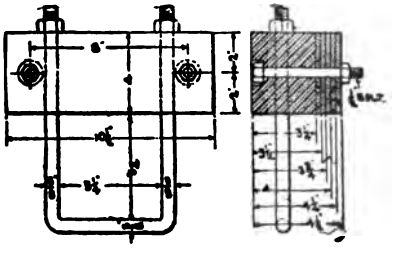
26. The CARS MUST BE JACKED APART by placing one jack on each side of couplers, separating the cars until the couplers are pulled out to the fullest extent, then inserting metal or hardwood blocks with plate washers to completely fill the space between horns of couplers and end sill, as shown in Fig. 204.

27. Wherever the lading is carried on more than one car, the cars should be chained together to prevent parting in case of failure of couplers. When cars are used which are not equipped with permanent safety chains, chains made of not less than one (1) inch iron must be passed around by body bolster and across under center sills, forming a loop back of bolster and doubling to point of coupling between the two cars and so tie them together, as shown in Fig. 205. These long chains must have only a sufficient amount of slack to permit the cars to curve.

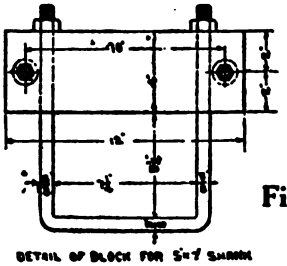
28. The INSPECTOR, in whose district the cars are to be loaded, must assure himself that the cars are properly blocked apart.

29. All DIMENSIONS given for blocking, bracing and bearing pieces are general, but represent the LEAST ALLOWABLE SIZE for loads exceeding one-half the capacity of car. For lighter loads the dimensions may be proportionately decreased, except where the size of timbers given is governed by the required

METAL SPACING BLOCKS FOR TWIN AND TRIPLE LOADS.

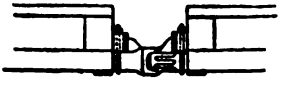


DETAIL OF BLOCK FOR 5½" SHANK



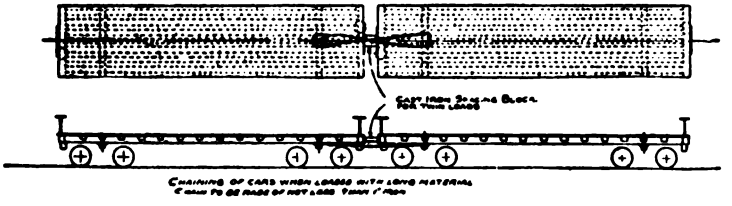
DETAIL OF BLOCK FOR 5½" SHANK

Fig. 204



METAL SPACING BLOCKS FOR TWIN AND TRIPLE LOADS.

Fig. 205



clearance; however, any material that may be suitable for blocking, which differs from the figures given, but which is of equal strength or stronger, may be utilized.

30. All material carried on two or three cars must always be examined by a competent INSPECTOR before the cars are moved from the loading point. If an inspector is not stationed at the loading point, the agent must give notice to the proper authority when the cars are loaded, so that proper inspection may be arranged for. The object of such inspection is to see that these regulations have been complied with.

31. If, in loading cars, it is impossible to clearly ascertain whether the restrictions given in General Instructions, under paragraphs 8 and 15, are complied with, the following tables may be used:

FOR LOADS AS PER FIGS. 208 AND 209.

Length of cars.	Length of lumber.	MAXIMUM WEIGHT OF LOAD.			
		Capacity of cars 40,000 lbs.	Capacity of cars 50,000 lbs.	Capacity of cars 60,000 lbs.	Capacity of cars 80,000 lbs.
30 ft.	30 ft.	38,000 lbs.	46,000 lbs.	57,000 lbs.	76,000 lbs.
	32 "	35,000 "	42,000 "	53,000 "	71,000 "
	34 "	32,000 "	39,000 "	49,000 "	65,000 "
	36 "	30,000 "	37,000 "	45,000 "	60,000 "
32 ft.	32 "	38,000 "	47,000 "	58,000 "	77,000 "
	34 "	35,000 "	44,000 "	54,000 "	72,500 "
	36 "	32,000 "	41,000 "	50,000 "	66,000 "
	38 "	30,000 "	38,000 "	47,000 "	61,000 "
34 ft.	36 "	36,000 "	45,000 "	55,000 "	73,000 "
	38 "	34,000 "	42,000 "	51,000 "	69,000 "
	40 "	32,000 "	39,000 "	48,000 "	64,000 "
	42 "	30,000 "	37,000 "	45,000 "	60,000 "

FOR LOADS AS PER FIG. 212.

WHEN LOADED ON CARS 34 FEET LONG.					Marked Capacity of Cars.	Maximum aggregate weight to be carried.
Length of lumber.	A	B	C	D		
40 ft.	10 ft. 8 in.	10 ft. — in.	5 ft. 9 in.	24 ft.	Lbs.	Lbs.
45 "	11 " 9 "	6 " 6 "	6 " 3 "	27 "	40,000	90,000
50 "	13 " — "	2 " 6 "	7 " — "	30 "		
60 "	17 " — "	2 " — "	10 " — "	33 "	50,000	105,000
WHEN LOADED ON CARS 30 TO 32 FEET LONG.					60,000	120,000
40 ft.	10 ft. 8 in.	8 ft. — in.	5 ft. 9 in.	24 ft.		
45 "	11 " 9 "	4 " — "	6 " 3 "	27 "	80,000	160,000

FOR LOADS AS PER FIG. 213.

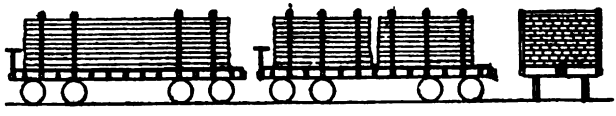
For material less than ninety (90) feet long, load per car should not exceed one-half of the marked capacity of the two end cars. For longer material, the load per car must conform to paragraph No. 15.

RULES GOVERNING THE LOADING OF LUMBER ON OPEN CARS.

DETAIL INSTRUCTIONS.

32. For flat cars and gondola cars with sides less than thirty (30) inches high, not less than four stakes four (4) inches wide by five (5) inches deep must be placed on each side of car, and the tops of opposite stakes must be held together by two one (1) by six (6) inch boards, fastened at

Fig. 206



LUMBER LOADED ON SINGLE CARS.

each end by means of three ten-penny wire nails, or by six strands equal to three wrappings of No. 8 wire. Gondola cars with sides thirty (30) inches high or over, must have six stakes not less than three (3) inches wide by four (4) inches deep on each side of car, and the tops of opposite stakes must be held together by two one (1) by six (6) inch boards fastened at each end by means of three ten-penny wire nails, or four strands equal to two wrappings of No. 8 wire.

33. When the length of lumber will permit, it must be similarly loaded in two piles with six stakes on each side of car. For flat cars and gondola cars with sides less than thirty (30) inches high, stakes must not be less than four (4) inches wide by five (5) inches deep, and for gondola cars with sides thirty (30) inches in height and over, stakes must not be less than three (3) inches wide by four (4) inches deep, in both cases secured as specified in Rule No. 32.

34. Lumber of equal widths must either be LAPPED OR HAVE STRIPS across loads at intervals of not more than thirty (30) inches high, to act as binders.

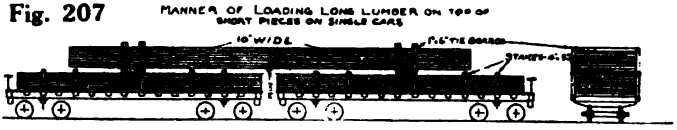
LUMBER LOADED ON TOP OF SHORT PIECES ON SINGLE CARS, AS IN FIG. 207.

35. Long pieces so loaded must rest on BEARING-PIECES not less than ten (10) inches wide and of sufficient thickness to

provide four (4) inches clearance at all points, securely fastened across the top of lading of each car, and stakes must be wired at bearing-pieces.

36. The STAKES must extend up as shown, and be held together at top with either wire or boards. (In accordance with Rule 32.) The short lumber must be placed centrally on each car, and the bearing-pieces must be placed half-way between the stakes and as near the middle of the car as possi-

Fig. 207

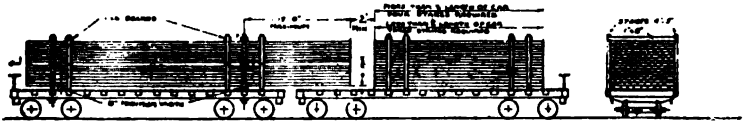


ble. Stakes must not be less than two (2) feet nor more than three (3) feet six (6) inches apart.

37. The MAXIMUM AGGREGATE WEIGHT must not exceed ninety (90) per cent of the marked capacity of the cars, and the amount of long lumber must not exceed one-half (½) the lading.

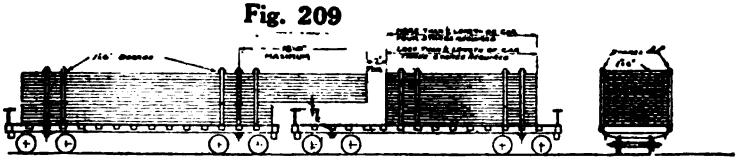
38. This material may be carried on one car, either in the manner shown in Fig. 208, when all the material is of nearly

Fig. 208



LADING OF LUMBER ON CARS.

Fig. 209



LADING OF LUMBER ON CARS.

equal length, or as shown in Fig. 209, when part of the material is long and part of the material short; the second car in both instances being simply an idler.

39. When the material is loaded in accordance with Fig. 208, the idler must invariably be a flat car, while the car carrying the load may be either a flat car or a drop-end gondola car.

40. When the material is loaded as per Fig. 209, the IDLER may be a gondola car, provided there is a clearance of at least four (4) inches between the bottom side of overhanging material and the top of sides or brake shaft of the idler.

41. The material on carrying car, when loaded as per Fig. 208, must rest on bearing-pieces not less than eight (8) inches wide, and of sufficient thickness to keep the ends of lumber at least four (4) inches above the floor of the idler, and in length equal to the full width of the car, to prevent the lading from touching the idler so that the cars can curve freely.

42. These BEARING-PIECES should be placed directly above the bolster, or as near to it as possible, but never between it and the end of the car. When the material is loaded as in Fig. 209, no extra bearing-pieces are required on the floor of the carrying car, as the short material loaded underneath the long material will take the place of the bearing-pieces.

43. The lading overhanging the idler, on Fig 208, must not project more than fifteen (15) feet from the center of the car bolster, and on Fig. 209 not more than eighteen (18) feet, and must be subject to restrictions in General Rules, so that the ends will not project too far beyond the side of the car in curving.

44. Short material may be loaded on the idler to the extent of two-thirds of its marked capacity.

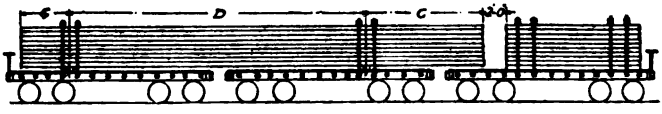
45. The FIVE STAKES on each side of the carrying car should be placed as near the bolsters as possible, and no stakes whatever should be used on the idler to confine the overhanging part. The only stakes permitted on the idler will be such as may be required for the short lumber loaded on the idler. Where the pile of lumber on the idler exceeds one-half (½) the length of the car, four stakes on each side should be used; three stakes on each side being sufficient for shorter piles. All stakes should be fastened as shown in Figs. 208 and 209 and as provided for in Rules 32, 35 and 36.

46. As the load on one truck of the carrying car is in excess of that on the other, and in direct proportion to the load on bearing-pieces and the overhang, care should be taken in all cases to load as near as possible to the brake staff of carrying car, but a clearance of not less than six (6) inches must be allowed between lading and brake wheel of carrying car, as per Rule No. 4.

47. This material (of any length) may be loaded on two or more cars.

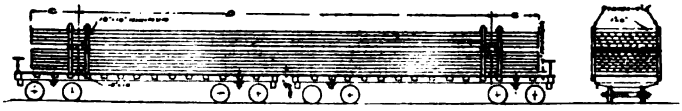
48. STAKES and bearing-pieces must be placed as indicated in the diagrams. Stakes must be wired at the center and fastened at the top with either boards or wire, in accordance with Rules 32, 35 and 36. Stakes must not be less than two (2) feet nor more than three (3) feet six (6) inches apart.

Fig. 210



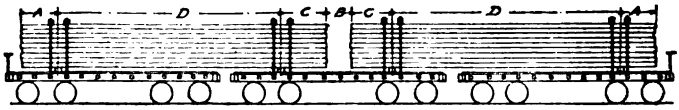
LADING OF LUMBER ON CARS.

Fig. 211



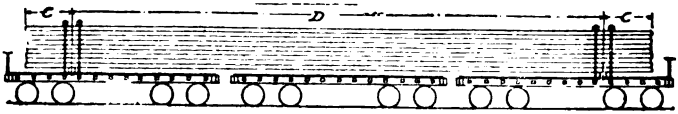
LADING OF LUMBER ON CARS.

Fig. 212



LADING OF LUMBER ON CARS.

Fig. 213



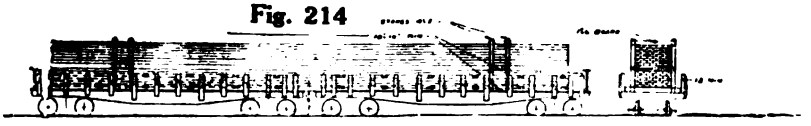
LADING OF LUMBER ON CARS.

49. BEARING-PIECES must not be less than ten (10) by ten (10) inches in section, and, if possible, should be placed at equal distances from the centers of bolsters on both carrying cars.

50. When necessary to make the width of lading less than width of car, on account of long overhang or distance between bearing-pieces, FILLING-PIECES must be placed between the stakes and lading and securely fastened to inside of stakes.

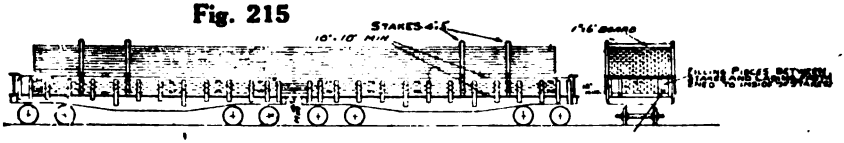
51. Long material may be LOADED ON GONDOLA CARS that have drop-end gates, provided that when loaded on two cars, BEARING-PIECES of not less than ten (10) by ten (10) inches are used to keep the lading clear of the end gates and floor by at

Fig. 214



LADING OF LUMBER ON GONDOLA CARS.

Fig. 215



LADING OF LUMBER ON GONDOLA CARS.

least four (4) inches, and in addition to the bearing-pieces on the floor there is a clearance at each side of load of at least eighteen (18) inches between the load and the car side and end gate stops at narrowest point to provide for curving. This clearance may be obtained by the use of stanchions, not less than four (4) by five (5) inches in section, placed in a vertical position, and securely fastened by cleats to the floor bearing-pieces in such a manner as to make the floor bearing-pieces serve as a brace between them, and to be fastened together with wire at center and either boards or wire at top as specified in Rules 32, 35 and 36. Not more than two gondola cars must be used together.

52. If the load projects above the sides of car, bearing-pieces not less than ten (10) by ten (10) inches, properly cleated on the inside of sides, must be placed on car sides,

and securely braced to prevent both longitudinal and lateral motion. The material placed on these bearing-pieces may be loaded to the full width of car. Stakes must be placed as shown in Fig. 215, and must be wired above car sides and again at top.

RULES GOVERNING THE LOADING OF DRESSED LUMBER.

53. If the lading consists of dressed lumber, and the shippers desire to do so in order to prevent sap stains, strips of rough lumber not more than two (2) inches nor less than one (1) inch thick, by not more than six (6) inches nor less than four (4) inches wide, may be placed crosswise between each layer of lumber. All strips over one and three-eighths (1⅜) inches thick must be six (6) inches wide. There must be one crosspiece to each pair of stakes on opposite sides of the car and between each layer of lumber. These strips must be of the same thickness for each layer of lumber, and must be neatly fitted between and butt against the stakes. When loaded as per Figs. 206, 207 and 209, the strips may be placed on the floor of the car as well as between the layers.

RULES GOVERNING THE LOADING OF LOGS, TELEGRAPH POLES, PILING AND PROPS ON OPEN CARS.

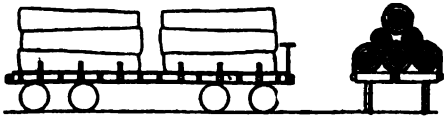
54. Material of this description must be loaded with the BUTTS AND TOPS ALTERNATING.

If the lading rests on two or more cars, it must rest on BEARING-PIECES not less than ten (10) by ten (10) inches in section.

LOGS.

55. All logs twenty (20) inches and over in diameter must be loaded in pyramidal form, with the largest logs at the bottom, as shown in Fig. 216, with the large ends of the first

Fig. 216



LADING OF LOGS ON CARS.

course toward the end of car. There must not be less than three pairs of STAKES of hardwood or live saplings squared or ends to completely fill the pockets. Stakes must be four (4) by five (5) inches in section, accurately fitted to stake pockets,

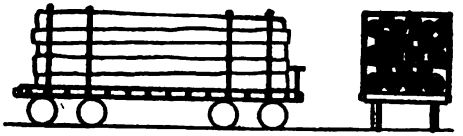
and to extend not more than ten (10) inches above car floor. For long logs there must be one pair of stakes for each length of five (5) feet or fraction thereof.

LOGS, PILING, PROPS AND TELEGRAPH POLES.

56. When material of this kind is not loaded in pyramidal form, the stakes must be as high as the lading, and must be tied together at the top with wire.

57. If the lading is more than four (4) feet high, OPPOSITE STAKES must be BOUND TOGETHER with wire at about one-third (1/3) the height above car floor after one-third (1/3) of the lading has been placed on the car, and in such a manner that when the remaining load is placed on the car the wire will have a tendency to draw the tops of stakes toward each other. The tops must also be tied with wire. (See Fig. 217.) This wiring must consist of not less than ten strands equal to five wrappings of No. 8 wire, and must be tight. If necessary, bearing-pieces may be placed between lower and upper sections of load to facilitate application of wire after all the lading has been placed on the car. Stakes must be sound hardwood, and free from knots. If saplings are used, they must be at least six (6) inches in diameter. Stakes must incline toward center of car a total of about twelve (12) inches before load

Fig. 217



LADING OF PILING, ETC., ON CARS.

is placed on car, and in no case will they be allowed to incline away from center of car after the car is loaded. The inspector must assure himself that all wiring is tight before load is moved.

58. When lading is placed on gondola cars and projects above car sides, stakes placed in proper stake pockets and wired at top must be used. If lading projects more than three (3) feet above car sides, opposite stakes must also be wired immediately above car sides.

59. Logs, piling and telegraph poles loaded on two or more cars should conform to Figs. 207, 210, 211, 212, 213, 214 and 215 and paragraphs 35, 36, 37 48, 49, 50, 51 and 52. If lading is less than four (4) feet high paragraph 56 should be followed, and when more than four (4) feet high paragraph 57 should be followed. The wiring of stakes should conform to

paragraph 57 (Logs on Single Cars) except that five turns or ten strands should be used in place of three turns or six strands.

THE LOADING OF TAN BARK.

FOR LOADS ON FLAT CARS.

60. When tan bark is loaded on flat cars there must be four stakes properly fastened at each end of car.

There must be at least four stakes at each side of car, accurately fitted to stake pockets. Two pairs of side stakes, those nearest center of car, must be fastened across the top by means of wire. The wiring should not be of less than two strands of No. 8 wire per pair of stakes, twisted sufficiently to hold stakes in a vertical position.

Two boards not less than one (1) inch by six (6) inches in section spaced four (4) inches apart, or one board one (1) inch by twelve (12) inches in section, must be securely nailed to inside of end and side stakes.

The load must extend to, but not beyond, the top line of the top board at time of loading.

Diagonal braces not less than one (1) inch by six (6) inches in section must be nailed to outside of car frame, or car sides, to outside of top boards and to inside of second stake from end of car, with not less than three ten-penny wire nails. At diagonally opposite corners of car, boards not less than one (1) inch by four (4) inches in section, spaced not more than two (2) feet apart, must be securely nailed to the inside of corner stake and the stake next to it, the top board to be not more than two (2) feet below the top of lading, in order to provide proper foothold.

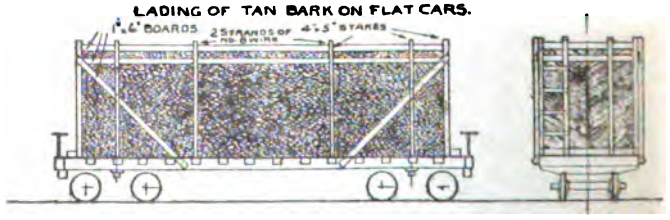
In loading, strips should be arranged vertically inside of the cross boards, or bark set on end so as to permit space for foothold and handhold at the cross pieces. Fig. 218.

FOR LOADS ON GONDOLA CARS.

61. Where tan bark is loaded in gondola cars there must be at least four stakes properly fastened at each end of car.

Fig. 218

LADING OF TAN BARK ON FLAT CARS.



and sufficient side stakes on side of car so that the spacing between stakes or between stakes and end of car does not exceed twelve (12) feet. Two boards not less than one (1) inch by six (6) inches in section spaced four (4) inches apart, or one board one (1) inch by twelve (12) inches in section should be securely nailed to inside of the end and side stakes about twelve (12) inches below top of stakes. See Fig. 219.

62. Gondola cars with sides less than thirty (30) inches high should be governed by the same rules as for flat cars.

63. Gondola cars, with sides thirty (30) inches high, must have end stakes secured at bottom by nailing a plank two (2) inches by four (4) inches in section to floor inside of bottom of stakes. Cars equipped with stakes so secured may be loaded to nine (9) feet above floor. If the load exceeds nine (9) feet in height, the tops of opposite stakes must be connected by wire or boards. For such lading the wire must consist of at least one strand of No. 8 wire.

Fig. 219

64. Gondola cars with sides more than thirty (30) inches high may be loaded to a height of nine (9) feet above floor without the use of plank nailed to the floor.

65. It will be the duty of the inspector to carefully examine the load to note that the bark is interlaced and sufficiently secured to make the lading safe for transit.

THE LOADING OF SLAB WOOD.

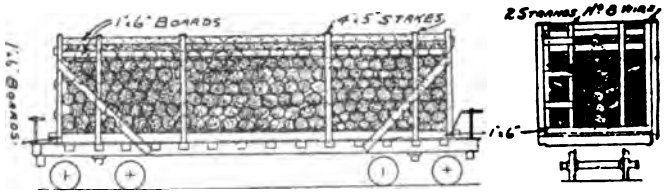
66. For loading slab wood exactly the same instructions as given above for tan bark shall be followed, but in addition there must be provided in all cases boards equivalent to not less than one (1) inch by six (6) inches in section at the top of the stakes, both at the sides and ends, and so arranged as to prevent slabs from sliding off the car.

66A. General instructions given for tan bark should govern the loading of lath, but, in addition, these rules should be followed:

Boards one (1) inch by six (6) inches in section, placed on edge, and fastened inside of side and end stakes, should be placed immediately above floor of car, to prevent the bottom layers of lath from shifting endwise or sidewise.

Immediately inside of lower course of side boards bundles of lath should be laid longitudinally, and a longitudinal row of bundles should be placed along center of car. Bundles should then be laid crosswise, butting against center longitudinal row, and resting on top of side longitudinal rows. Succeeding courses should be laid crosswise in the same manner, butting against additional longitudinal rows laid between them over center line of car. Opposite stakes must then be fastened together with either boards or wire, in the same manner as required for tan bark. At diagonally opposite corners boards should be applied, to provide proper foothold and handhold, as required for tan bark, except that these boards may

Fig. 220 LATH LOADED ON FLAT CARS



be nailed to outside instead of inside of stakes, as required when loading tan bark.

RULES GOVERNING THE LOADING OF TIES, FENCE POSTS AND SIMILAR LADINGS ON OPEN CARS.

SHOWN IN FIG. 221.

67. Flat cars loaded with cross ties or fence posts will not be accepted for shipment.

68. Gondola cars will be accepted with load not to exceed four (4) feet above the end gate of car. Each tier must be loaded flat wise IN A PYRAMIDAL FORM above the end gate, so as not to wedge and spread the sides. Lading must not extend over the sides of car.

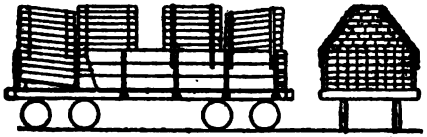
69. If load extends more than twelve (12) inches above end gate at center, each pile must have at least two binders, which shall not extend less than fifteen (15) inches over side plank of car, and must be secured at each side of car with at least three staples or nails, or shall be fastened to any layer of ties below the top of side plank. Each binder shall be fastened to each tie in passing over the load. When fastening is

made as last described, the attachment to the ties must be made on both sides of the load, and the binder brought together at top of pyramid and fastened by twisting and securing both ends of the binder with staples to the load.

70. When wire is used it must not be of less gauge than No. 8, and but one strand may be used.

71. When SAPLING is used it must be of green timber, split,

Fig. 221



LADING OF TIES, ETC., ON OPEN CARS.

and not less than one and one-half (1½) inches wide on the split or flat side.

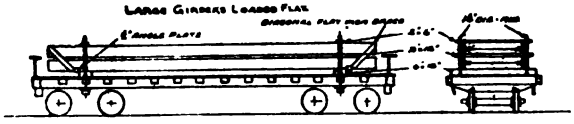
RULES GOVERNING THE LOADING OF LONG STRUCTURAL MATERIAL, PLATES, RAILS, GIRDERS, ETC., ON OPEN CARS.

DETAIL INSTRUCTIONS.

LOADS ON SINGLE CARS.

72. LARGE GIRDERS, LOADED ON FLAT SIDE ON FLAT CARS, must always be carried upon bearing blocks, not less than six (6) by twelve (12) inches, bolted to car floor with seven-eighths

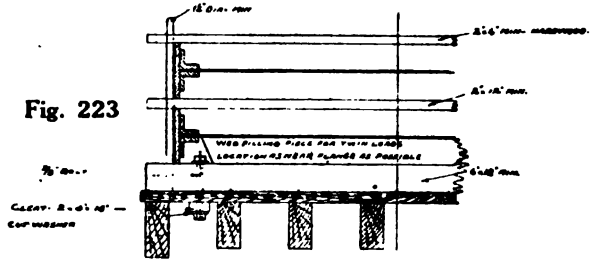
Fig. 222



(⅞) inch bolts. The bearing blocks must be placed one over each bolster, and two (2) by four (4) by eighteen (18) inch cleats must be placed longitudinally under floor and cut washers under bolt heads and nuts. In addition, spacing blocks not less than two (2) by twelve (12) inches must be placed between each girder. Lateral motion must be prevented by means of upright iron stanchions not less than one and one-quarter (1¼) inches in diameter, driven into holes in the bearing-pieces and held together at the top by not less than

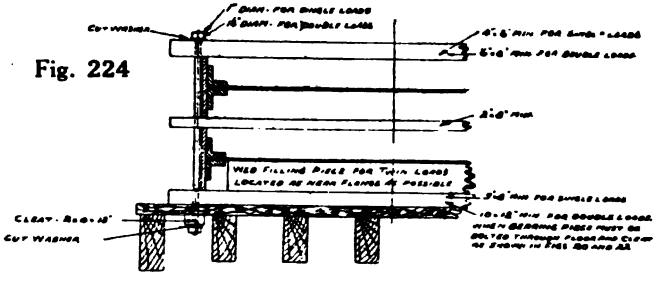
two (2) by six (6) inch planks (hardwood), as shown in Figs. 222 and 223, or it may be prevented by fitting planks between flanges of the girders, as shown in Fig. 225. Girders may also be CLAMPED TOGETHER as shown in Fig. 224. When so loaded, the blocking used must not be less than three (3) by eight

Fig. 223



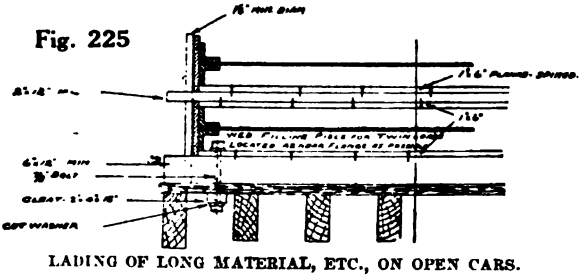
LADING OF LONG MATERIAL, ETC., ON OPEN CARS.

Fig. 224



LADING OF LONG MATERIAL, ETC., ON OPEN CARS.

Fig. 225



LADING OF LONG MATERIAL, ETC., ON OPEN CARS.

LADING OF LARGE GIRDER OVERHANGING. **Fig. 226**

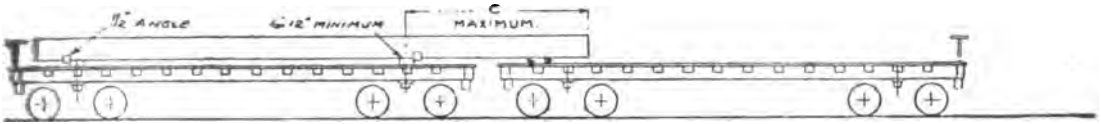
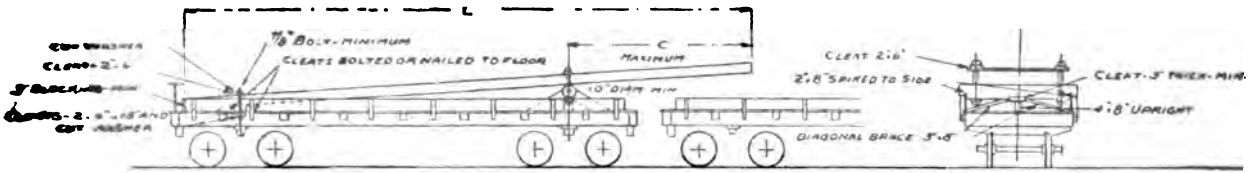


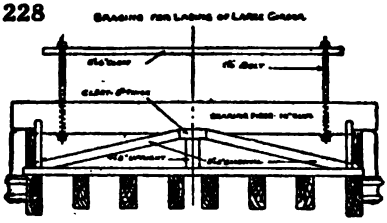
Fig. 227



OVERHANGING LOADS ON SINGLE CARS, AS PER FIGS. 226 AND 227.

(8) inches for bearing-blocks on car floor, two (2) by eight (8) inches for spacing-blocks, and four (4) by six (6) inches (hardwood) for top tie planks. The vertical rods must not be less than one (1) inch in diameter, and must, if possible, pass through the blocking and floor of car. Further, with loads twenty-four (24) inches high or over, braces must be added, as shown in Fig. 249. To prevent longitudinal motion, angle plates five (5) or six (6) inches wide by one-half (½) inch

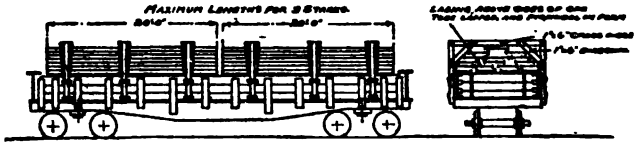
Fig. 228



thick, must be bolted firmly to the lower girders close to the bearing-pieces, as shown in Fig. 222, or if rivet holes are not available it may be prevented by clamps, as shown in Fig. 224. The upper girder must be held to the lower girder by diagonal flat iron braces bolted to both girders, as shown in Fig. 222. If, however, girders are clamped together, as shown in Fig. 224, the diagonal flat iron braces need not be applied.

73. Large girders, loaded as shown in Fig. 226, must be

Fig. 229 LADING OF SHORT STRUCTURAL MATERIAL.



SECURED TO CARRYING CAR, as described in paragraph 72 and Fig. 224.

74. When loading short structural material on single gondola cars, in separate piles, as shown in Fig. 229, the pieces forming each pile must be lapped, and must be blocked to solidly fill the whole space between sides of car. Lading projecting above car sides must be placed in pyramidal shape, and opposite stakes must be fastened together at top by means of boards. Diagonal braces must be placed close to sloping

sides of lading, and fastened at each side of each stake and tie boards by not less than three ten-penny nails. To avoid longitudinal sliding, one piece not less than six (6) by eight (8) inches in section must be securely bolted to car floor, at each end, and close to lading. For piles up to twenty (20) feet long, at least three pairs of stakes, and for longer piles four pairs of stakes must be used.

75. Open girders, half-roof trusses, and similar material

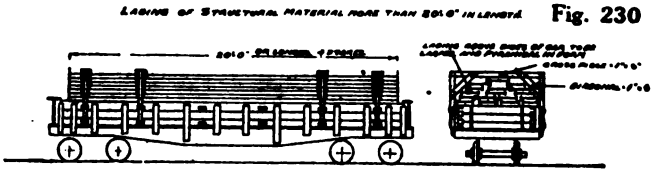


Fig. 230

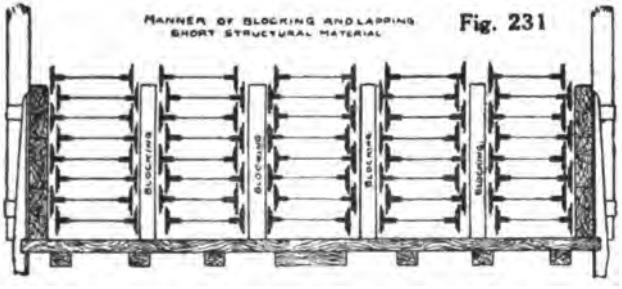


Fig. 231

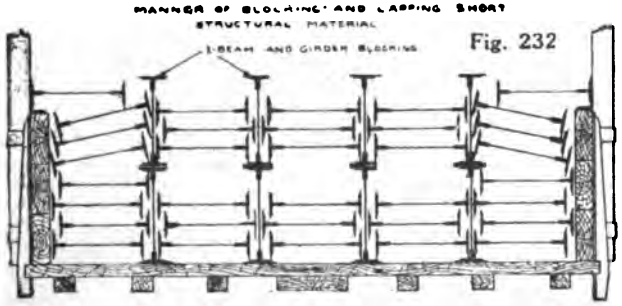


Fig. 232

loaded on gondola cars, as shown in Fig. 234, must rest on two bearing-pieces not less than six (6) inches wide and four (4) inches thick. Two other timbers of same size must be placed above lower chord of trusses or girders, and securely bolted through bearing-pieces, floor and longitudinal cleat under floor. Load must be secured from shifting transversely by two stakes on each side, and opposite stakes fastened together by means of tie boards passing under and touching top chords of trusses or girders. Two blocks about a foot in length and of sufficient height to block outside girders must be securely nailed with not less than six ten-penny wire nails, between tie boards against outside girders. Diagonal braces must be fastened to stakes and cross-tie boards.

WHEN LOADED IN GONDOLA CARS, AS SHOWN IN FIG. 227.

76. One end must rest on a BEARING-PIECE not less than ten (10) inches wide and of sufficient depth to prevent the lading

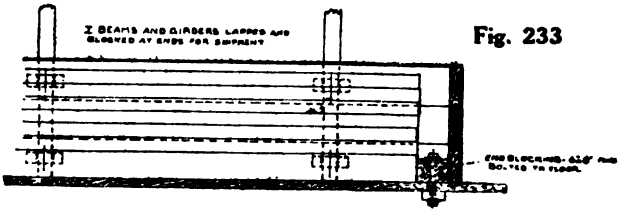
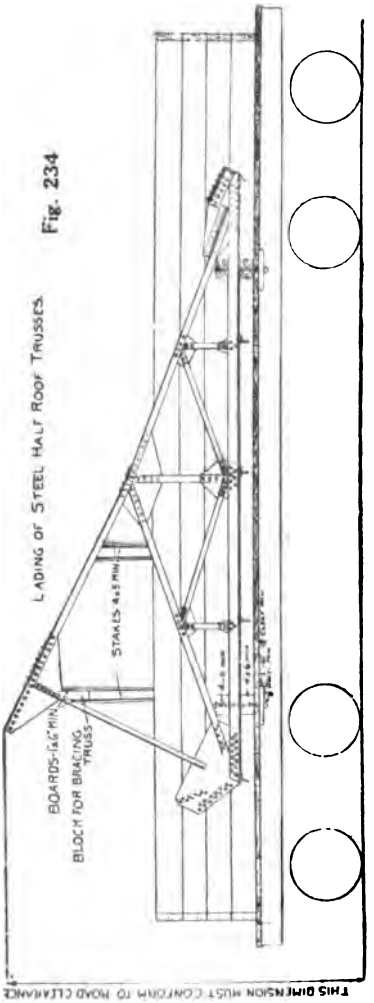


Fig. 233

at end of car from touching the floor; the bearing-piece to be placed on the floor above the bolster and extending the width of the car, and must be secured from shifting by cleats nailed or bolted to the floor. The end boards at this end of the car must be protected by blocking fitted between the side boards so as to prevent any part of the load from injuring the end boards of the car. The thickness of the blocking may vary according to the weight of the lading, but should never consist of less than one three (3) inch plank set on edge for loads of less than one-half the capacity, nor less than two three (3) inch planks or their equivalent for loads of more than one-half (½) of the capacity of the car, and must be secured from shifting by cleats nailed or bolted to the floor.

77. If the OVERHANG exceeds one-third (⅓) of total length of load, the opposite end must be securely bolted through bearing-piece to floor by means of seven-eighths (⅞) inch bolts

78. If the DEPTH OF LOAD IS MORE THAN TWENTY-FOUR (24) INCHES, THE BRACING for bearing-piece on top of sides of car must be the same as shown in Fig. 249.



LADING OF STEEL HALF ROOF TRUSSES. Fig. 234

79. If the lading which butts against the end boards consists of only a single piece or two of a weight not exceeding a total of six thousand (6,000) pounds, no end blocking is required.

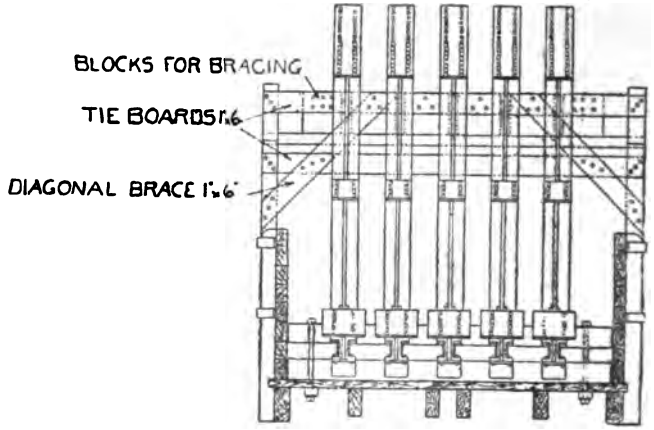
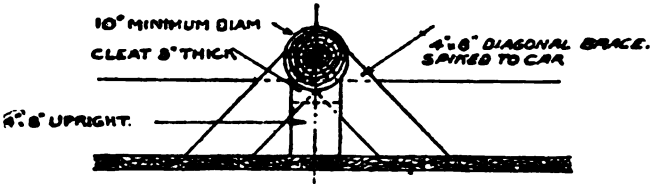


Fig. 234 (Continued.)

(END ELEVATION.)

MANNER OF BLOCKING ROUND BEARING PIECES. Fig. 235



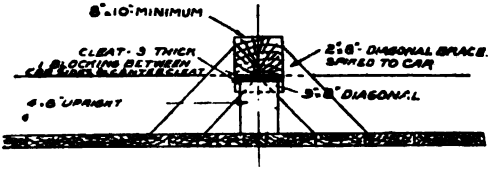
80. When the lading consists of very FLEXIBLE MATERIAL, such as plates, no bearing-piece is required on the floor of the car, but blocking must be used to protect the end boards.

81. The other end of the load must rest upon a bearing-piece, square or round, preferably square, not less than eight (8) by ten (10) inches if square cornered, nor less than ten

(10) inches in diameter if round, for loads of over one-half (½) the capacity, and proportionately smaller to less weight of lading. This bearing-piece must rest on the side boards of the car, within one (1) foot of either side of the center line of the bolster, and must have the ends notched for the side boards and be securely braced to prevent both lateral and longitudinal motion, as well as bending and rolling. Figs. 235 and 236 show substantially how both bearing-pieces are to be made and secured.

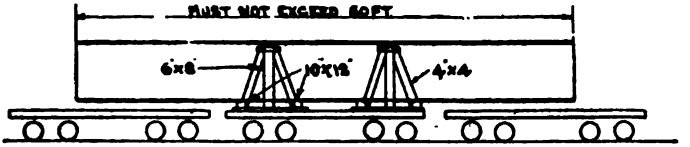
82. If the OVERHANGING MATERIAL is very FLEXIBLE and interferes with the end boards of the adjacent car, a suitable

Fig. 236 MANNER OF BLOCKING. RECTANGULAR BEARING PIECES



LADING SINGLE CARS OVERHANGING BOTH ENDS.

Fig. 237



bearing-piece protected by a strip of iron must be placed on the adjacent car to support the material.

83. The IDLERS used with loads as shown in Fig. 226, must be flat cars, unless the width of the overhanging load is at least three (3) feet six (6) inches less than the width given for each length of overhang in the table of paragraph 11, in which case a drop-end gondola car may be used.

84. The IDLER used with loads as shown in Fig. 227 may be a low-side gondola car, but must have at least four (4) inches clearance vertically between load and idler body or brake shaft.

LOADS ON SINGLE CARS, OVERHANGING BOTH ENDS OF CAR AS PER FIGS. 237, 238 AND 239.

85. This method of loading may be made use of to load long lattice girders, which would be injured if loaded on more

thar one car. From a point of safety in transit, it is a very undesirable method and should be used only when absolutely necessary.

86. For loads of this character FOUR BEARING-PIECES must be placed in pairs on the carrying car, each pair being placed centrally above the bolster, with a distance apart of not over

LADING SINGLE CARS OVERHANGING BOTH ENDS.

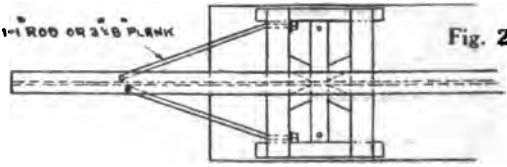
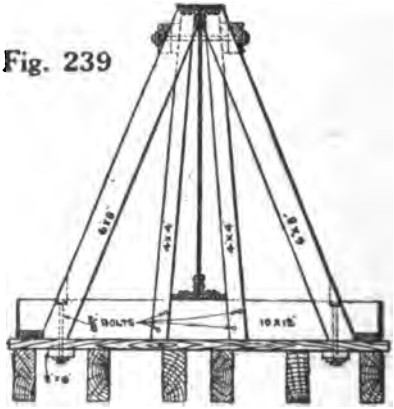


Fig. 238

LADING SINGLE CARS OVERHANGING BOTH ENDS.

Fig. 239



five (5) feet nor less than three (3) feet; they must be fastened to the floor with bolts, and the upright supports must have side braces.

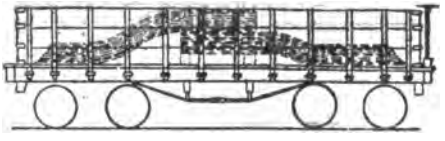
87. Braces or tie-rods must be secured to the overhanging ends and to the bearing-pieces, as shown in Fig. 238. Longitudinal motion must be prevented by the use of plates or clamps, as explained in paragraph 72.

LOADING FLEXIBLE PLATES ON SINGLE CARS.

88. When plates are loaded on the floor of single high-side gondola cars, BEARING-PIECES must be placed on the floor to facilitate the removal of the lading. These bearing-pieces should not be less than three (3) by four (4) inches in section, extending the width of the car. There should not be less than two bearing-pieces to a car.

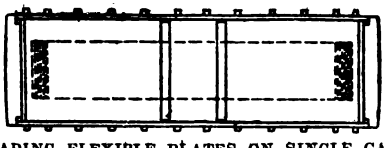
89. When plates are loaded on single cars and the length of the plates is such that it becomes necessary to lap the plates on each other at the center of the car, bearing-pieces not less than eight (8) by eight (8) inches in section and of length corresponding to the distance between the side planks, must

Fig. 240



LADING FLEXIBLE PLATES ON SINGLE CARS.

Fig. 241



LADING FLEXIBLE PLATES ON SINGLE CARS.
(Plan View of Fig. 240.)

be placed on the floor of the car above the cross-bearers to prevent the breaking down of center sills and stringers, as shown in Figs. 240 and 241.

TWIN LOADS.

90. Material loaded ON GONDOLA CARS WITH DROP-ENDS OR ON FLAT CARS, as shown in Fig. 242, must have one bearing-piece not less than ten (10) inches wide by twelve (12) inches deep secured to the floor of each car with two seven-eighths (⅞) inch bolts, and lateral and longitudinal motions must be prevented in the manner described in paragraph 72 and Fig. 224,

Fig. 242

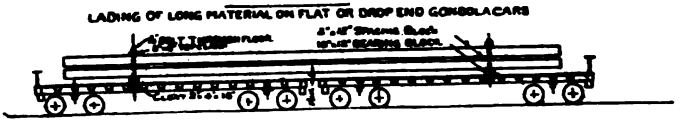


Fig. 243 LADING OF LONG MATERIAL ON GONDOLA CARS.

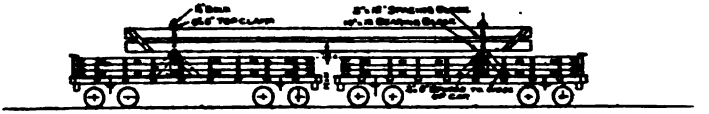


Fig. 244

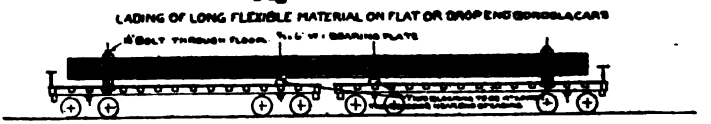


Fig. 245

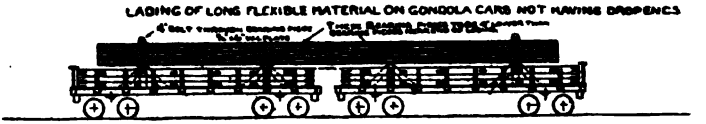


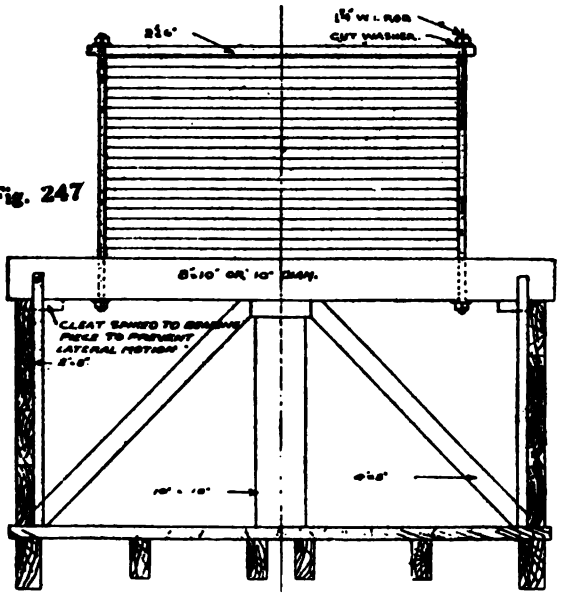
Fig. 246

using one and one-quarter (1¼) inch vertical rods and six (6) by eight (8) inch top clamping pieces. When the lading consists of "I" beams lying flat, or similar material, or when there is danger of the flanges cutting into the bearing-pieces, the webs of such material must be supported by web pieces or the lading must be placed on pivoted bolsters.

91. In case of gondola cars, a clearance of at least eighteen (18) inches on each side between the load and car sides and end gate stops at narrowest point must be provided for curving.

92. Material loaded on gondola cars without drop-ends,

Fig. 247



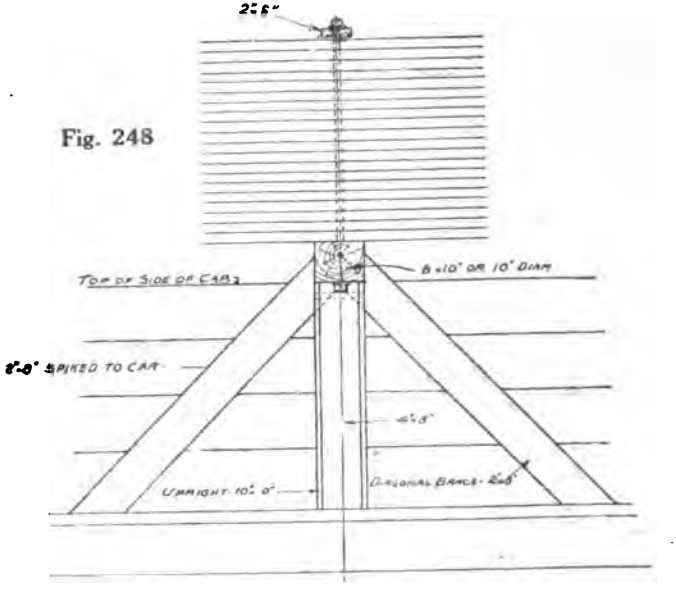
TWIN SHIPMENTS ON GONDOLA CARS NOT EQUIPPED WITH DROP ENDS.

as shown in Figs 243, 245 and 246, must have bearing-pieces placed on the top of the sideboards, of the same size and secured in the same manner as described in paragraph 81.

93. LONG FLEXIBLE MATERIAL, like plates, etc., which can not be loaded as shown in Fig. 227, must be loaded on four or more bearing-pieces, as in Figs. 244, 245 and 246; the two cen-

ter bearing-pieces must be four (4) inches lower than the end pieces and have flat iron one-half (½) by six (6) inches secured to their upper sides, either with spikes or lag screws at each end. These iron pieces, which are intended to facilitate curving, must extend at least sixteen (16) inches beyond each side of the lading AND MUST BE COATED WITH GREASE BEFORE THE LADING IS PLACED UPON THEM. The bearing-pieces must be secured to the car and the material clamped together

Fig. 248



TWIN SHIPMENTS ON GONDOLA CARS NOT EQUIPPED WITH DROP ENDS.

to prevent it from shifting, in the manner described in paragraphs 72 and 81.

94. The BEARING-PIECES at each end of the load are the only ones to be provided with vertical rods and clamping pieces. When the bearing-pieces are located near the center of the cars, as is the case with the end pieces in Fig. 245, and when the load so carried is equal to one-half (½) the capacity or over, the bearing-pieces must be secured with lateral brac-

ing pieces, as shown in Fig. 249, to prevent the breaking down of the sides when going around curves.

95. When material is LOADED ON FOUR BEARING-PIECES on gondola cars with drop-ends, the same clearance must be provided between the lading and the car sides, as specified in paragraph 91.

96. If more THAN FOUR BEARING-PIECES are required to properly support the lading, the center pieces only on each car must be provided with vertical rods and clamping pieces as described in paragraph 72 and as shown in Fig. 246, all other bearing-pieces to have flat iron secured to their upper sides to allow for curving, as provided for above. For loads of this kind the OVERHANG is measured from the bearing-pieces to which the lading is clamped, to the end of the material.

97. If, in order to make up the allowable carrying capacity of the cars, SHORT MATERIAL IS LOADED ON THE FLOOR, with loads as per Figs. 243, 245 and 246, such material must be loaded in equal amounts on both sides of the car, so as to be properly balanced and not interfere with the curving of the trucks.

98. All structural material and plates more than sixty (60) feet long, also girders more than four (4) feet high, loaded on two or more cars in a vertical position, must be loaded on pivoted bolsters shown in Figs. 257 and 258. The bracing shown is for long girders. For other material the bracing must be equally strong.

99. THE MINIMUM DIMENSIONS of detail parts for different weights of lading are given in the table on the following page.

NOTE.

A. Struts must be neatly fitted and driven into place.

B. Diagonal bracing to girder may be either by means of rods, shown on the right side, or by means of flat iron, shown on left side of plan view. If diagonal brace rods at one end are attached to girder between bolsters, those at the other end must likewise be attached to girder between bolsters, or brace rods at both ends may be attached to overhanging ends of the girders.

C. Bolts through rivet holes in girder should be not more than one-sixteenth (1/16) inch less in diameter than the holes.

D. Bolsters, when made of two or three pieces, as per notes I and K, must be securely fastened together by means of bolts in location marked (X).

E. Filling-pieces should be placed between stringers of the same length and directly underneath center plate backing. Six bolts should be used to tie the two pieces together.

LIST OF MATERIAL.

NAME.	Designation.	No. Wanted.	For girders weighing not more than 30,000 lbs.	For girders weighing more than 30,000 lbs. and not exceeding 72,000 lbs.	For girders weighing more than 72,000 lbs. and not exceeding 115,000 lbs.
Bolster	A	1	8″×10″ wide×9′6″	10″×14″ wide×9′6″	12″×16″ wide×9′6″
Struts	B	2	*6″×8″	*6″×10″	*6″×12″
Center plate backing	C	1	3″×12″×5′	3″×12″×5′	3″×12″×5′
Side bearing backing	D	2	3″×10″×5′	3″×10″×5′	3″×10″×5′
Bolster side stops	E	2	† ×10″×2′	† ×10″×2′	† ×10″×2′
Side bearing, plate, bottom	F	1	6″×⅜″ ×3′6″	6″×⅜″×3′6″	6″ × ⅜″× 4′
" " " top (bent)	G	1	6″×¼″ ×1′3″	6″×¼″×1′7″	6″×¼″+1′9″
Center plate, bottom	H	1	12″×⅜″×12″	12″×⅜″×12″	12″×⅜″×12″
" " top	J	1	12″×⅜″×12″	12″×⅜″×12″	12″×⅜″×12″
" pin	K	1	2½″ diam.	2½″ diam.	2½″ diam.
Strut straps	L	4	5″×⅜″×1′6″	5″×⅜″×1′6″	5″×¼″×1′6″
" angles	M	2	3½″×5″×⅜″×9½″ long	3½″×5″×⅜″×18½″ long	3½″×5″×⅜″×15″ long
Flange clamps	N	2	6″×¼″×1′4″	6″×1″×1′4″	6″×1″×1′4″
Brace rods	O	2	1″ rod or 2½″×¼″ flat	1¼″ rod or 3″×¼″ flat	1¼″ rod or 3″×⅜″ flat
Bolts for center plate backing	P	6	⅝″ diam.	⅝″ diam.	⅝″ diam.
" " flange clamps	Q	4	⅝″ "	⅝″ "	⅝″ "
" " strut straps	R	8	⅝″ "	⅝″ "	⅝″ "
" " " angles	S	4	⅝″ "	⅝″ "	⅞″ "
" " " tops	T	4	⅞″ "	⅞″ "	1″ "
Strut top irons	U	2	6″ channels, 4′10″ long	6″ channels, 4′10″ long	6″ channels, 4′10″ long

*May be made of two pieces, securely bolted together. †To be ¼″ less than flange of girder.

F. For girders more than seventy (70) feet long, one center-pin hole should be made oblong, in car body, as shown in small diagram, permitting two (2) inches longitudinal motion.

G. Girders more than eight (8) feet deep, and weighing less than thirty thousand (30,000) pounds, should have bolster equipment specified for girders weighing more than thirty thousand (30,000) pounds and less than seventy-two thousand (72,000) pounds.

Fig. 249

STRUCTURAL MATERIAL LOADED ON FLAT CARS.

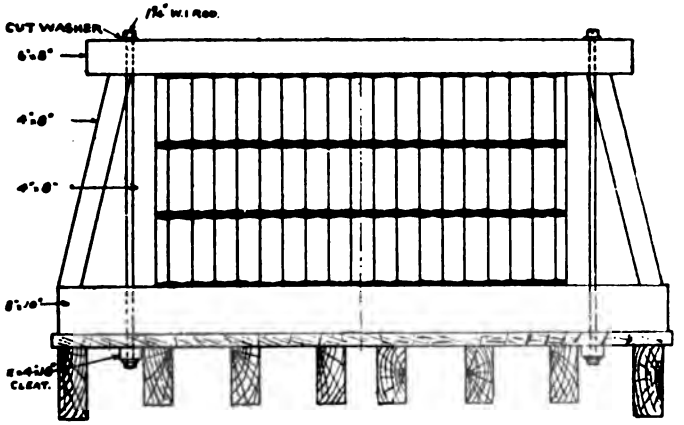


Fig. 250

LADING OF STRUCTURAL MATERIAL ON FLAT CARS.

Fig. 251

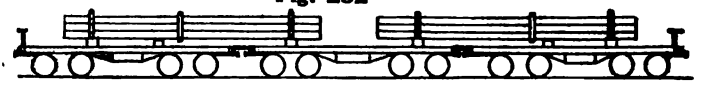
LADING OF STRUCTURAL MATERIAL ON FLAT CARS.
(PLAN VIEW OF FIG. 250.)

H. For girders more than fifty (50) feet long, if necessary to pass a curve of more than twenty (20) degrees curvature, nuts on one bolster should be loosened to allow girder to shift on bolster. After curve is passed the original firm condition must be restored.

I. The ten (10) by fourteen (14) inch bolster may be built up of two pieces ten (10) inches deep by seven (7) inches wide, or a bolster eight (8) inches deep and twenty (20) inches wide made of two pieces eight (8) by ten (10) inches may be substituted.

K. The twelve (12) by sixteen (16) inch bolster may be

Fig. 252



LADING OF STRUCTURAL MATERIAL ON FLAT CARS.

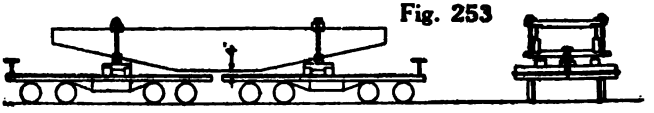
built up of two pieces twelve (12) inches deep and eight (8) inches wide. A bolster ten (10) inches deep by twenty-four (24) inches wide made of three pieces ten (10) by eight (8) inches, or a bolster eight (8) inches deep by thirty-six (36) inches wide made of three pieces eight (8) by twelve (12) inches, may be substituted.

RULES GOVERNING THE LOADING OF TURNTABLES.

100. Turntables may be loaded either RIGHT SIDE UP, as shown in Fig. 253, or UPSIDE DOWN, as shown in Fig. 254.

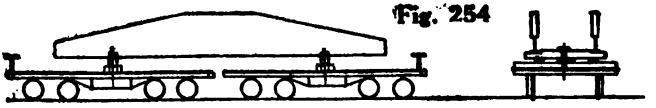
101. Each turntable, when loaded right side up, must rest on two cribbings made of timber not less than ten (10) inches square, notched and securely bolted with seven-eighths (⅞) inch bolts.

Fig. 253



LADING OF TURNTABLES.

Fig. 254



LADING OF TURNTABLES.

102. The LOWER TRANSVERSE TIMBERS of the cribbing must extend the full width of the car, and must be bolted to the car floor, between the stringers, with one seven-eighths (⅞) inch bolt at each end of each timber. Underneath the floor must be placed boards two (2) by six (6) inches in section, and of sufficient length to allow all the bolts on a side to pass through a board.

103. When the height of the cribbing will be sufficient by the use of one transverse and one longitudinal course of timbers besides the bolster which is secured to the table, the TRANSVERSE TIMBERS on the floor, of which there should not be less than two, should be placed not less than eighteen (18) inches apart, and the three top timbers must be notched in between the floor timbers, as shown in Fig. 253.

When the required height of the cribbing makes it necessary to use three or more courses of timber, the distance between the floor timbers must be correspondingly increased.

104. Turntables loaded on two or more cars forming TWIN LOADS must rest on pivoted bolsters, which must be firmly fastened to the turntable. The bolsters, center plates, center pins and side bearings must conform to dimensions given in table of paragraph 99.

105. The BOLSTERS may be held to the TURNTABLE either in the manner shown in figure, or if rivet holes are available in the lower flanges, it may be held with four three-fourths (¾) inch bolts at each end. They must also be secured to the cribbing by a center pin two and one-half (2½) inches in diameter, passing through bolster, center plates and top timbers of cribbing.

106. The BOLSTER SUPPORT on car must not be less than six (6) inches deep by eighteen (18) inches wide and must be securely fastened to car floor with two seven-eighths (⅞) inch bolts at each end, or the support may be made as shown for long girders. Figs. 257 and 258.

RULES GOVERNING THE LOADING OF ROLLED MATERIAL OF SMALL SECTIONAL AREA.

107. Rails, bar-iron, channels, angles, etc., should, whenever possible, be loaded on SINGLE GONDOLA CARS INSIDE OF END GATES, which must, in all cases, be raised and securely fastened.

108. Single flat cars, when used for loading this material must be provided with substantial hardwood end blocking not less than four (4) inches thick, securely braced to prevent shifting lengthwise or may be securely clamped to the floor of car whenever possible in accordance with Fig. 224.

109. Material of this description, when loaded on two or more cars, should be secured as shown in Figs. 250, 251 and 252.

110. The intermediate BEARING-PIECE or pieces must be two (2) inches lower for material six (6) inches high or over, and four (4) inches lower than the main bearing-pieces for material less than six (6) inches high, and must have flat iron one-half (½) by six (6) inches secured to their upper sides, either with spikes or lag screws, at each end. These iron pieces, which are intended to facilitate curving, must extend

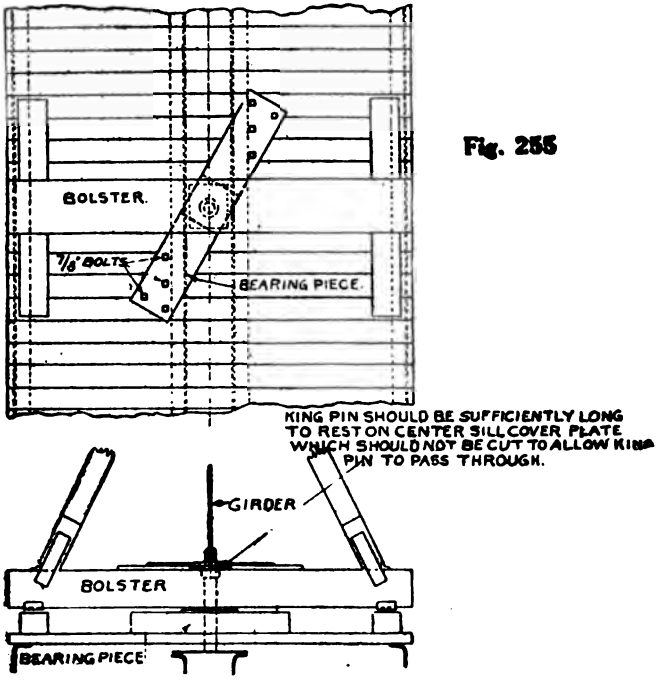

BOLSTER.
7/8" BOLTS
BEARING PIECE.
KING PIN SHOULD BE SUFFICIENTLY LONG TO REST ON CENTER SILL COVER PLATE WHICH SHOULD NOT BE CUT TO ALLOW KING PIN TO PASS THROUGH.
GIRDER
BOLSTER
BEARING PIECE

Fig. 255

VERTICAL LADING OF LONG GIRDERS. LOCATION OF BEARING PIECE FOR BOLSTER FOR TWIN LOADS. CARS EQUIPPED WITH STEEL UNDERFRAMING.

at least sixteen (16) inches on each side of lading, and MUST BE COATED WITH GREASE BEFORE THE LADING IS PLACED UPON THEM.

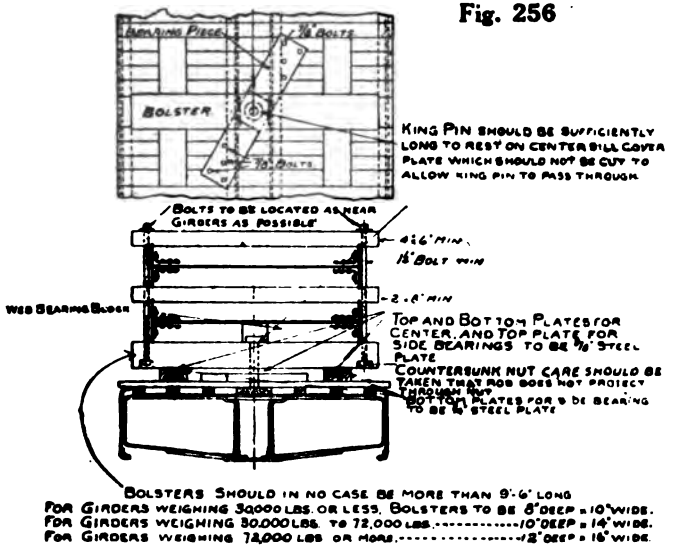
111. When LOADED ON TWO OR MORE CARS, the material must be fastened at the center by means of two vertical pieces of timber not less than four (4) by five (5) inches in section,

held together by means of two one and one-quarter (1¼) inch iron rods, as shown in Figs. 250, 251 and 252.

RULES GOVERNING THE LOADING OF PIPE ON OPEN CARS.

112. Pipes twelve (12) inches or less in diameter must be loaded in gondola cars. Gondola cars loaded higher than top of sides with pipe twelve (12) inches or less in diameter, should have the sides pulled together, after pipe has been

Fig. 256


BOLSTER
KING PIN SHOULD BE SUFFICIENTLY LONG TO REST ON CENTER SILL COVER PLATE WHICH SHOULD NOT BE CUT TO ALLOW KING PIN TO PASS THROUGH
BOLTS TO BE LOCATED AS NEAR GIRDERS AS POSSIBLE
4'-6" MIN.
1" BOLT MIN
2'-6" MIN
WEB BEARING BLOCK
TOP AND BOTTOM PLATES FOR CENTER, AND TOP PLATE FOR SIDE BEARINGS TO BE ⅜" STEEL PLATE
COUNTERSUNK NUT CARE SHOULD BE TAKEN THAT ROD DOES NOT PROJECT THROUGH
BOTTOM PLATES FOR SIDE BEARING TO BE ⅜" STEEL PLATE
BOLSTERS SHOULD IN NO CASE BE MORE THAN 9'-6" LONG
FOR GIRDERS WEIGHING 30,000 LBS. OR LESS, BOLSTERS TO BE 8" DEEP × 10" WIDE.
FOR GIRDERS WEIGHING 50,000 LBS. TO 72,000 LBS. ---------- 10" DEEP × 14" WIDE.
FOR GIRDERS WEIGHING 74,000 LBS OR MORE. ---------- 12" DEEP × 16" WIDE.

HORIZONTAL LOADING OF LONG GIRDERS ON PIVOTED BOLSTERS. CARS EQUIPPED WITH STEEL UNDERFRAME.

loaded to top of sides, by means of a rod with turnbuckles, or any other available means, until the side stakes are slightly inclined toward the center of the car. Opposite stakes should then be secured by means of ten strands or five turns of No. 8 wire immediately above car sides, and further lading of pipe should be placed on this wiring. Top of stakes should then again be secured by wire. There should not be less than three stakes on each side for each pile.

113. All pipe more than twelve (12) inches and less than twenty-four (24) inches in diameter must be loaded with all

bell or sleeve ends toward same end of car and interlocking with each other. Ends of pipe must not be less than eighteen (18) inches from ends of car. The bell or sleeve ends of top

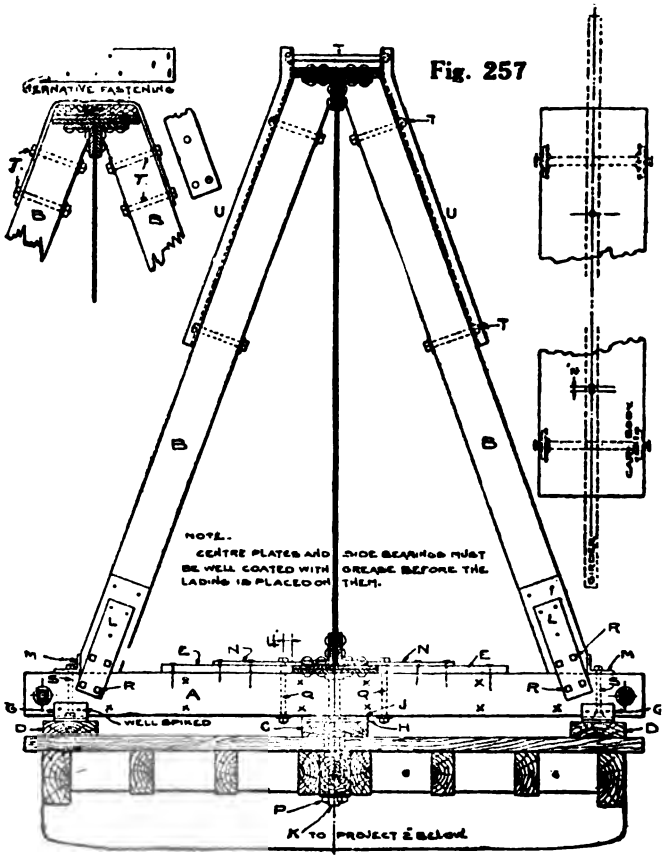


Fig. 257
ALTERNATIVE FASTENING
NOTE.
CENTRE PLATES AND SIDE BEARINGS MUST BE WELL COATED WITH GREASE BEFORE THE LADING IS PLACED ON THEM.
WELL SPIKED
K TO PROJECT 2 BELOW

LADING OF LONG GIRDERS ON PIVOTED BOLSTERS.

course must overlap those of the course immediately below. Each course must be separated from the course immediately below by a bearing-piece of timber not less than four (4) inches

thick by five (5) inches wide, extending across the lading and secured at stakes with at least two twenty-penny nails at each

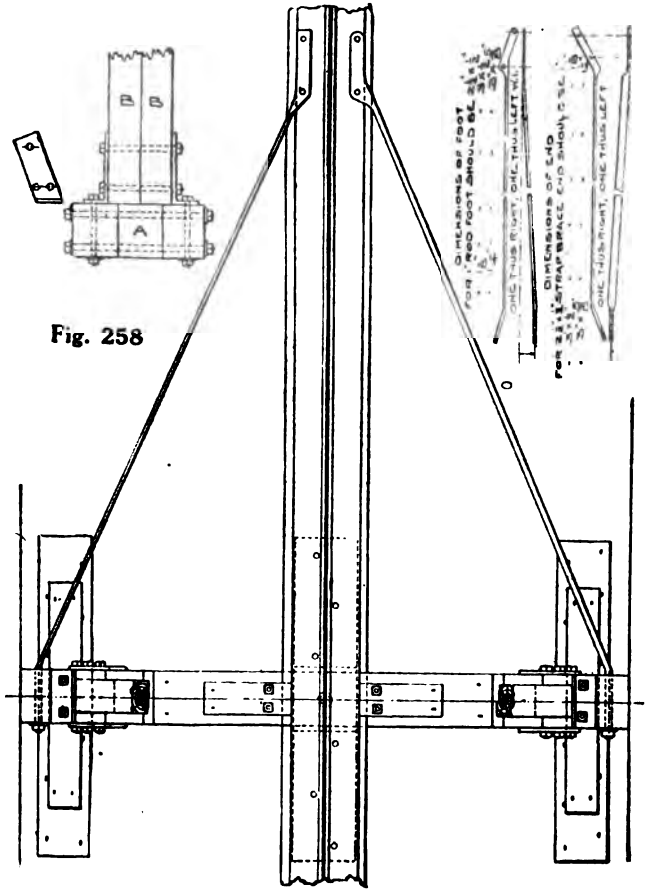


Fig. 258

LADING OF PIPE ON OPEN CARS.

stake. The bearing-piece at bell or sleeve end of pipe to be placed as near the bell or sleeve end of the pipe as location of

stake pockets on car will permit. Each pile to have all courses secured on each side by blocking at least six (6) inches high by five (5) inches wide, fitted and driven under the outside of pipe, beveled at outer end and securely fastened to the floor of the car as well as each cross bearing-piece, with four twenty-penny nails to each block, two through the ends and one properly toe-nailed through each side of the block. Each end of the bottom course must be provided with end blocking not

Fig. 259

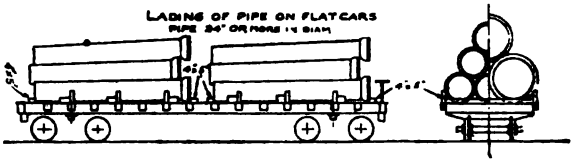


Fig. 260

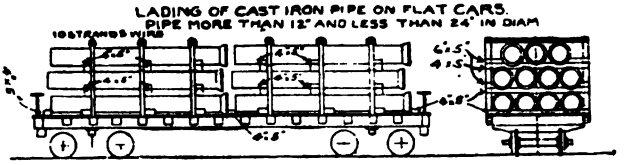
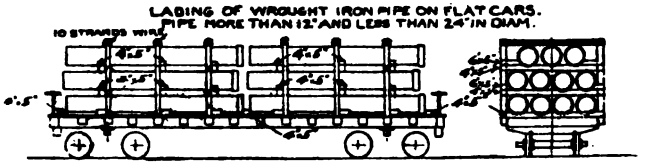


Fig. 261



less than four (4) inches by five (5) inches, in section, securely fastened to floor of car.

114. There must not be less than three pairs of stakes to each pile when the material is less than eighteen (18) feet long, or more than four (4) feet high above top of sides when gondola cars are used. The tops of each pair of stakes to be held together by means of one (1) inch by six (6) inch boards or ten strands or five turns of No. 8 wire resting on the pipe.

For pipe more than eighteen (18) feet long there must be at least four pairs of stakes.

115. All pipe twenty-four (24) inches or more in diameter must be loaded in pyramidal form with all bell or sleeve ends toward the same end of car, and interlocking with each other. The ends of the pipe must not be less than eighteen (18) inches from the end of the car. The bell ends of the top course must overlap those of the course immediately below. The bottom course must be securely blocked on each side of each pile with not less than three blocks eight (8) inches long, and of a height equal to one-quarter (¼) the diameter of the pipe. These blocks must be neatly fitted to the pipe, shouldered and beveled on the outside and secured against displacement. Each end of the bottom course must be provided with end blocking not less than four (4) inches by five (5) inches in section, securely fastened to the floor of the car.

116. BLOCKING of more than fourteen (14) inches in height will not be required, but on ladings of pipes three (3) feet or over in diameter there must be additional blocking formed by a plank not less than two (2) inches thick, fitted under the outside of lading and spiked to each stake with four twenty-penny nails.

117. There must be three STAKES not less than fifteen (15) inches high above the floor of the car on each side of each pile, where pipe is loaded in pyramidal form.

RULES GOVERNING LOADING OF STONE ON OPEN CARS.

118. All large flagging, block or break-water stone, with approximately STRAIGHT FACES, loaded on flat cars, should REST ON STRIPS spaced eighteen (18) inches apart placed crosswise on car and of sufficient thickness to keep the stone clear of the car floor. Cars so loaded shall be provided with hardwood stakes or cleats to prevent side or end shifting.

119. All large block or break-water stone, RESTING ON UNEVEN FACE, shall be WEDGED to prevent stone from rocking, and cars so loaded shall be provided with hardwood stakes or cleats to prevent side and end shifting.

120. All stone that is not safe to load as per paragraphs 118 and 119, such as rip-rap, spawls, paving block, etc., must be loaded on cars provided with side and end boards, securely staked and fastened.

CHAPTER XIV.

THE PASSENGER CAR—FRAMING, PLATFORM, TRUCKS.

Included in the denomination "passenger cars," are various kinds that might not strictly be so considered, but the custom is to describe as passenger cars all that are regularly used in passenger trains or are fitted up for that service. In this classification then we find baggage, mail and express cars, besides those specially arranged to carry passengers in various degrees of ease and comfort. Different combinations are sometimes made in a single car; baggage and mail, and baggage, mail and smoking room are some of these. Other examples of cars fitted up entirely for a single service are mail, baggage, smoker, coach, chair, sleeper, dining and private cars. In all cases the general construction of the car framing is the same.

The specially arranged diagram shown in Plate XI. illustrates in detail the different parts of passenger, buffet, sleeping and observation cars. It also outlines the special equipment supplied for heating and lighting, together with a vestibuled and an observation platform.

Passenger cars are generally 50 feet in length though longer cars are built, but when longer than fifty feet, the added weight requires the use of a six-wheel truck. The width depends on the physical condition of the road such as tunnels, bridges, etc. Generally speaking, it may be said

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that the width varies in different parts of the country and on different roads from 9 to 11 feet measured over the side sills. The average height of passenger cars from the top of the rails to the top of the clear story roof is about 14 feet, 3 inches.

But few railroad companies build their own passenger cars, evidently because it has been demonstrated that the work can be more cheaply and effectively performed by private car manufacturers making a specialty of this business.

The floor framing is, in general construction, very similar to that of freight cars, consideration being made for the difference in length. The material for the longitudinal sills is usually long leafed Southern yellow pine, while white oak is selected for the end sills and cross-tie timbers. However these latter members are very often made of bulb-iron or deck beams. With a very long car, a second set of cross-tie timbers is used, placed between the ones at the center of the car and the body bolster.

The longitudinal sills are at least six in number, but for all the most modern large cars there are eight. A general idea of the framing of the floor timbers can be obtained from Figure 262, which also shows the platform timbers, the double bolster for a six-wheel truck and the truss rods which are used only under the outside sills.

Practically all the various types of bolsters used for freight cars are adaptable for passenger cars. When a four-wheeled truck is used under a light car, the single bolster is usually placed about six feet from the outside face of the end sill.

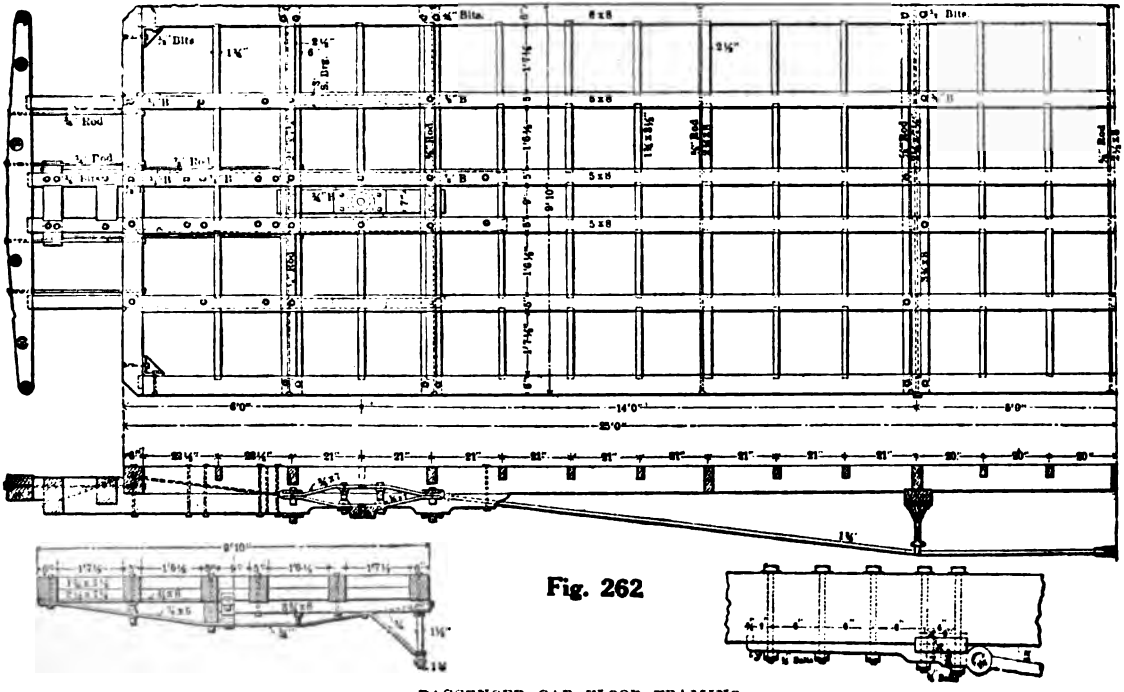


Fig. 262

PASSENGER CAR FLOOR FRAMING.

However when a six-wheel truck is to be used, there is a little more complication in the arrangement of bolsters. The six-wheeled truck was introduced because of the great weight to be carried. For the same reason the double transom arrangement is used. Although slightly more expensive than the single transom, this double arrangement is much more preferable, because the load is distributed more widely and the end of the car is held up from sagging, due to the shorter distance from the end sill to the first bolster. The space between the two bolsters is spanned by a built up beam (a trussed design being shown in Figure 262) to which the center plate is secured. This center plate is ordinarily about eight feet from the outer face of the end sill for cars using six-wheel trucks.

The floors of passenger cars are usually double, the first layer being at least one inch thick, matched and grooved, placed diagonally across the car. The top or finished course is about ⅞-inch thick, matched and grooved and extends lengthwise of the car. Yellow pine is used considerably for both courses, maple is also selected for the upper layer, especially in the aisles. Special precautions are also taken in the flooring to deaden the sounds, a layer of tar or building paper being put on top of the sills under the lower floor course. Further precautions are to seal up the space between the longitudinal sills and fill the openings with some sound deadening material, such as saw-dust or mineral wool.

The side framing of passenger cars is composed of posts, plates, tie rods, belt and panel rails, panel furring and the needful bracing. (Plate XI Nos. 399 to 505.)

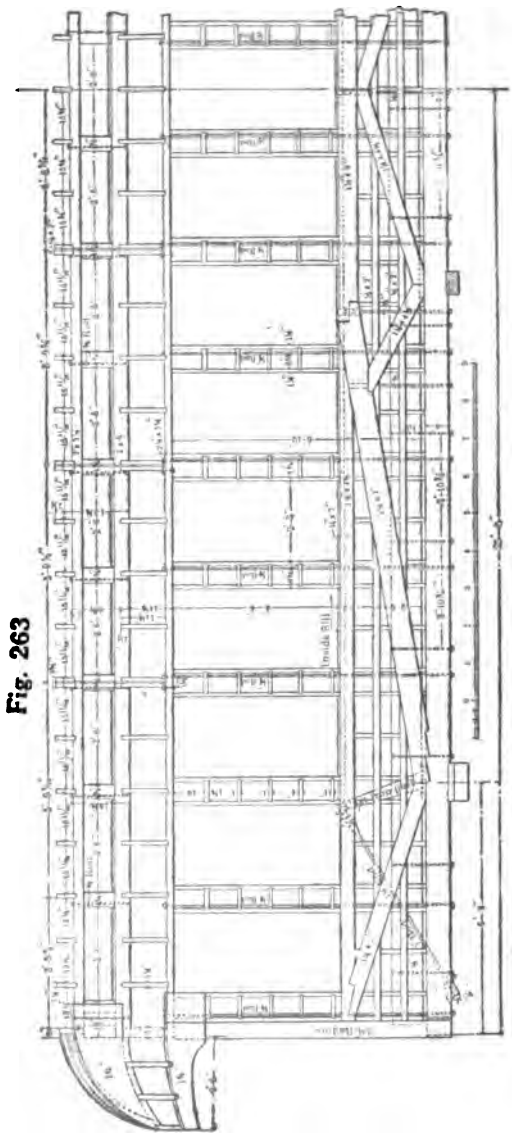


Fig. 263

PASSENGER CAR SIDE FRAMING.

The full length posts, with the exception of those at the corners, are window posts; they range in size, the dimensions depending on the requirements of the window sash and blinds or curtains; 1¼ by 4 inches is probably the average size used. The posts are framed to both sill and plate with tenons, which are usually 1¼ inches thick, those entering the sill being 3 inches long and of a driving fit for the purpose of giving the car lateral stiffness.

The plates vary in size from 2x5 to 4x6 inches; the latter size, or one approximating it, is used when the plate is set on edge, as is usual in baggage and express cars. For passenger cars it is preferable to apply it with the side up, because it is desirable to have as much room above the windows as possible, and even with this, the space is insufficient when the window has but one sash, that is when it is without a transom. In such cases the plate is provided with slots, which permit the sash to ascend until stopped by the roof boards. The plate is secured by vertical rods placed at intervals of about 3 feet or at every second post; these rods are either of ⅜-inch iron and have ½-inch screw ends or are ½-inch throughout, the former plan being adopted to reduce weight; but the reduction is small when compared with the total weight of the structure.

The outer edges of the posts are notched to receive the belt, and, between this and the sill, one, but usually two, panel rails. The belt rail was formerly, and is in many instances yet, a part of the outside finish, and is in that case not less than 2½ inches thick, 1¼ inches of which,

or the thickness of the panels and battens, project beyond the face of the posts. The width is about 4 inches, the protruding portion being beveled on top where it comes in contact with the outside window sill, and grooved or rabbeted on the lower edge to receive the panels or siding. Usually the belt rail is of the same thickness as that of the panel rails, which is 1½ inches, and is, like these, let in flush with the face of the post. To avoid the cutting away of the posts more than this is absolutely necessary, and at the same time add to the rigidity of the frame by locking the joints, the gains in these are not more than one inch deep, the remaining ½ inch being taken from the rails themselves. The rails are secured in place with wood screws, the panel rails with one and the belt with two to each bearing.

Above the belt, when the space between the windows is not so narrow that the posts themselves occupy the whole of it, three or four blocks, termed window panel furring are provided. These are of pine or some other soft wood, are from ⅞ to 1¼ inches thick, and of the same width as the window posts when the inside panel is not let in flush, in which case they are the thickness of this, narrower. The furring blocks rest in shallow gains cut in the sides of the posts, and are fastened with glue and nails.

The bracing in the side frames of passenger cars is of necessity confined to the space below the windows, and as this is comparatively low and the different members constituting the truss are limited in size, this cannot be relied upon to carry the weight without truss rods, but if prop-

erly constructed will materially aid in doing so. There are several different styles of bracing, each of which is claimed to be the best by those using it; generally speaking, that in which the members are long and the joints consequently less numerous is less apt to sag, although it possesses the disadvantage that it cannot be adjusted when once out of shape without removing the outside covering.

Figure 263 illustrates a common form of framing and side-trussing. In addition to the framing the sides and ends also are blocked in. That is, blocks not less than ⅞-inch thick are carefully fitted to each opening between posts and braces. These blocks are either set in and glued against stops or the posts are slightly gained to receive them. As a result of this blocking, the car side is made a practically continuous board, giving it great rigidity and strength.

The principal members of the end frames of passenger cars are the corner and door posts. Both are shaped in the form of a quarter circle, the radius of which is usually 5½ and 5 inches respectively. The corner post is framed to the plate with a tenon, but is secured to the sill with screws only; the supplemental posts, however, which are so securely attached to it with both glue and screws, so as to make the whole practically one piece, have tenons at the lower ends also. A lintel of the same circular section as the door posts themselves, and usually also of wood, although cast-iron arches are sometimes used, connects these at the top and forms a rectangular opening with slightly rounded corners. The top of the door opening is also frequently a semi-

circle, elliptic, or perfectly straight, with sharp corners, the latter mostly for both the end and side doors of baggage and kindred cars, it being

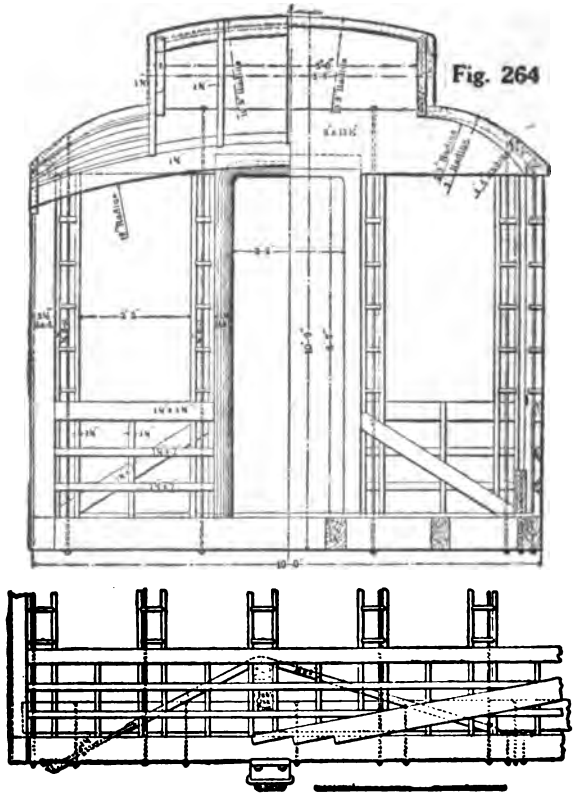


Fig. 264

PASSENGER CAR END FRAMING.

in that case often nothing more than a piece of board covering the lower edge of the plate.

The studding and belt and panel rails are the

same as those at the sides, although the former are perhaps 1 or 1½ inches narrower when end windows are omitted, as is the case in sleeping cars and frequently in day coaches also. The braces are in that case—that is, if braces are introduced at all to stiffen the frame—longer and extend to the angle formed by the junction of the door post with the plate.

The end plate is usually 2½ or 3 inches thick and from 15 to 17 inches wide in the center; this last dimension being governed by the pitch of the rafters, which also determines the outline to which the upper edge is shaped. The plate is secured to the side plate and deck sills with joint bolts and to the end sill with four ⅝-inch tie rods.

In the construction of roofs of passenger cars a clear-story or upper deck is generally used, this form of construction being advantageous for purposes of ventilation and light. The clear-story or deck side is composed of a sill and plate, and posts separating these. The posts and tie rods passing through these, correspond in number and location to the side window panels, there being as many deck as there are side windows. The rafters which form the connection between the deck sill and side plate are usually not less than 1½ inches thick, about 5 inches wide at the lower end, 2½ inches at the upper end; both edges are curved to a given radius or shaped to whatever other outline the fancy of the designer may select. The rafters are attached to the plate with at least two large screws in each and to the deck sill with a pin and tenon or a tenon and a small joint bolt; they are spaced about 18 inches

from centers, when this is practicable—in a day car there is one to every window and panel. The deck carlines, which are spaced to correspond with the rafters, are 1½x2 inches, and are also curved, but to a much larger radius.

An iron carline is introduced either every 6 feet, or at every second panel, for the purpose of strengthening the roof vertically. It is a flat bar of ⅝ or ¾x2 inch iron set on edge and bent to conform to the contour line of the roof and deck; the ends are bent at right angles where they meet the plates, and are attached to these with two ½-inch bolts in each. The iron, or compound carline, as it is designated, because it is attached to the sides or between the wooden rafters and deck carlines, is placed flush with the upper edges of these, but the vertical portions project from the deck sides the full width of the iron; to let them in flush would cut in two both the sill and plate. The projections are, however, not objectionable, because they are usually hidden by the deck screens.

The roofs of passenger cars are usually covered with tin, canvas being sometimes used. The tin, or whatever other material the roof proper may be composed of, is supported by the roof boards. These are tongued and grooved strips of from ⅝ to ¾ of an inch thick, which are applied longitudinally and securely held in place by screws or nails. It is advisable to use as wide boards as possible; these are made sufficiently pliable to form the required convex surface by partially cutting through them, if necessary, longitudinally at intervals of from 2 to 3 inches; ordinarily, however, boards not much

wider than this are used. For the roof ends it is necessary to use very narrow, thin and pliable strips and apply them in two layers to obtain the required thickness; in most cases straight grained pine or poplar will answer this purpose, but when the curves are very severe bass wood is used.

The outside covering of passenger cars is generally of yellow poplar; that wood being non-resinous and having a close grain affords a good foundation for paint. It goes without saying that it must be well seasoned and free from sap.

The form of exterior generally adopted dispenses with panels as they are expensive to maintain, being liable to check and split. Narrow tongued and grooved boards are used. To obtain the best effect, the strips should be very narrow, from 1½ to 2 inches, exclusive of the tongues, or be centerbeaded if they are double this width. The form of these so-called beads, but which are in reality grooves, is semicircular or V-shaped with either sharp or rounded corners, the latter being the more popular; the grooves are very minute and do not exceed 3-16 of an inch. The boards are secured in place in all properly constructed cars by blind nailing through the tongues, with glue applied at the back and joints; if more than 2 inches wide some additional nails are driven through the face of the boards also.

The construction of the deck side exterior varies with the arrangements made for windows and ventilation. In the case of stationary windows, a light covering surrounds the openings and covers the face of the frame and a soffit board and eaves molding complete the finish. When the deck sash is on hinges for purposes of ven-

tilation, a screen is placed several inches distant from the windows, and this with the addition of a narrow fascia board and molding forms the exterior.

The inside lining is principally arranged for decorative effect. The inside lining or finish is generally as follows: The wainscoting, as that portion below the windows and above the truss plank is termed, is either composed of narrow matched and beaded strips applied longitudinally, or of three members, two rails and a panel. Both the upper and lower rails in that case are ¾ of an inch thick and about 6 inches wide, the former requiring to be substantial, as the seat, back, arms and stops are attached to it. The rails are rabbeted to receive the panel which is ½-inch thick. There is usually no great attempt made to ornament this part of the finish; the edges of the rails are, however, chamfered or molded, and sometimes a series of grooves or beads is cut in the panel.

On the upper wainscot rail rests the inside window sill; this is about ½x4 inches, and is nailed to the above rail and to the window sill furring. In some cases a window sill cap and belt molding under the sill proper are added, but ordinarily nothing more than a single member is used.

The wood work above the windows is usually arranged in much the same fashion as that below these and with rails and panels of about the same thickness. Sometimes nothing more than these three members are used, in which case the panel becomes a belt molding, its surface being variously shaped, beaded and carved. In other

cases the rails are continuous, but the panels are in short sections, usually corresponding in length to the width of one or more windows. They are separated by stiles framed in between the rails with a mortise and tenon. The edges of both the stiles and rails are chamfered, or molded, and grooved to receive the panels. The panels may be flat and surface carved, be beaded or have raised centers, which may be left plain or be ornamented with carved rosettes, beads, etc.

The space between the windows is lined with panels which are applied vertically. These are about ¾ of an inch thick, and usually very elaborately ornamented with grooves and carving.

At the junction of the side and head lining is a large molding to properly terminate the wall finish; and supplementing this, very often a narrow fascia board, the lower edge of which is notched or in some other way ornamented.

Some additional work is required at the ends unless the ceiling is hipped, in which case the side finish is simply continued until it meets the door opening. In other cases the additional space is paneled.

The deck finish consists of a ½-inch facing around the window openings, a cornice at the deck ceiling and a more or less ornamental deck sill facing with one or more moldings.

The head lining is either a painted canvas or of three-ply veneer, the center of which is of ⅛-inch poplar. It is manufactured in molds of the exact curve required and in sections corresponding in length to the spacing of the side windows. These sections are secured in place

with nails and the whole surface is divided off into panels by narrow moldings, some of which are necessary to cover the joints. The veneer head lining is always more or less decorated, but is usually not painted, although this is done in some instances, especially when the design is partially in relief.

The saloon and other partitions are built up of stiles, rails and panels, much in the same manner as a door is constructed and are of a design in keeping with the finish at the sides; the stiles and rails are about 1¼ inches thick.

The interior of baggage and similar cars is not so elaborate. The sides and ends are lined with matched and beaded boards of the usual dimensions, which are applied horizontally. Ordinarily there is no head lining in such cars; the roof boards are beaded on the under side and the rafters, deck sills and plates, etc., are dressed and chamfered; a molding and fascia board at the junction of the roof and lining complete the finish.

A distinctive feature of passenger equipment is the platforms at the ends of the car and the devices used for coupling. (Plate XI Nos. 336-398.) The Miller hook and platform was one of the early devices which was designed to meet the requirements of the situation. It materially aided in the smoothness of handling passenger trains and reduced to a minimum the jerking in stopping and starting trains.

Illustrations (Figures 265, 266, 267 and 268) show the original drawings of the Miller device, which remained practically unchanged in its general plan up to the time of its

retirement by the M. C. B. Coupler, and three-stem buffer. The hooks or couplers were generally solid forged iron or steel castings. The bolt connection was sometimes changed to a strap or yoke. The follower plates, originally of cast iron, were generally wrought iron about 1¼ inches thick. The draw and buffer springs shown in the drawings are of the volute type, but the general practice became to use springs of the same dimensions and resistance as those used in freight cars. The drawbar side or stop castings were modified so that their removal when removing springs or follower plates was avoided, this being accomplished by using loose wrought bars bolted to the castings in place of the lower retaining flange.

The buffer as shown is an iron or steel forging consisting of three parts, the head, the bar and the stem. The stem passes through the spring and buffer spring beam, in the rear of which it is fitted with a strong cotter to retain it. The shoulder formed by the junction of the stem with the bar bears directly on the spring, if this is of the volute pattern, but if it is a spiral a plate must be provided. The bar is rectangular in section to prevent turning, the guide is retained in its socket by a plate attached to the face of the end timbers.

A pair of 3 or 4-inch timbers, termed platform timbers, which resemble the draw timbers in shape, extend back to the bolster, and are bolted to the intermediate and end sills, together with the draw timbers form the foundation of the platform. The two short beams, the platform sills framed in between the end sills and end timber,

may be dispensed with if the intermediate floor timbers, and consequently the platform timbers also, can be placed to meet the requirements of the platform floor.

The platform end timber, which is in its larg-

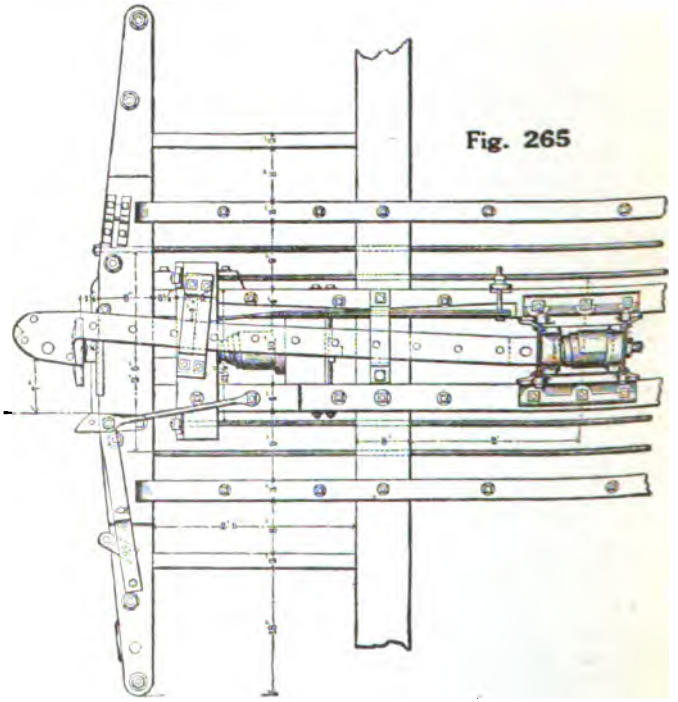


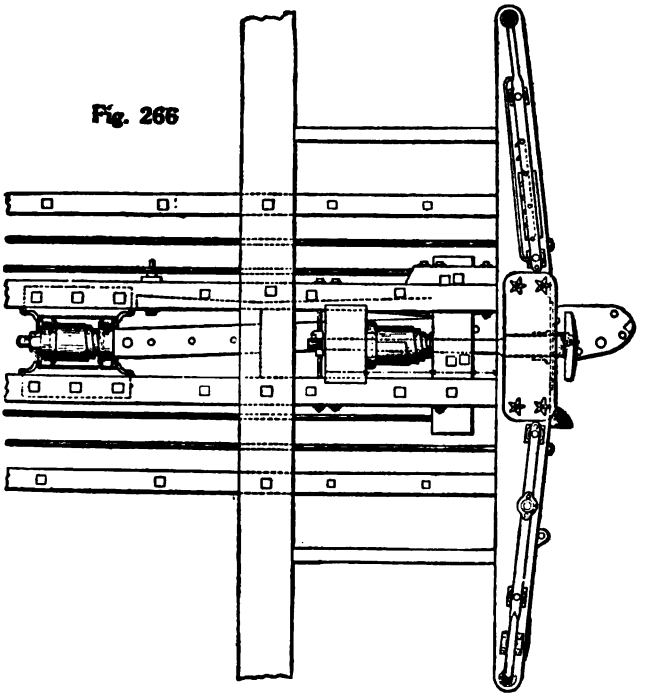
Fig. 265

MILLER PLATFORM AND HOOK.

est cross section 8 inches wide and 7 inches deep, and otherwise shaped as shown, is kept in place by two ¾-inch rods usually running back to the transom, and in addition to this by two ⅝-inch

rods located close to the platform sills, but extending through the end sill only. The end timber, which is raised above the platform timbers one inch, or the thickness of the floor so as to be flush with this, carries the end railing, un-

Fig. 266

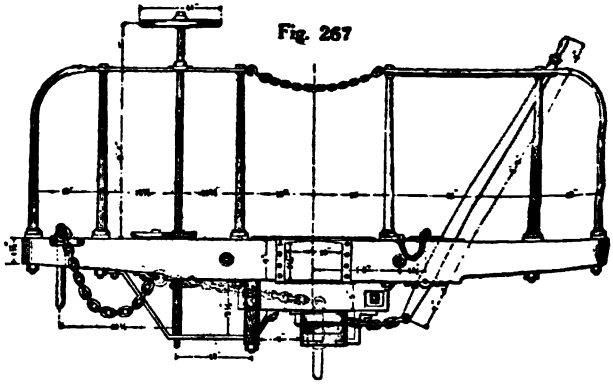


MILLER PLATFORM AND HOOK.

coupling lever, brake shaft and coupler guide or stop. The railings, ordinarily of wrought iron, are supported on four wrought-iron tapering posts, which are firmly attached to the timber by

means of nuts, and are braced by large cast-iron washers or sockets. The uncoupling lever, which passes through a slot in the timber, and is pivoted to the under side of this by suitable trunnion plates, is connected with the coupler by a short chain; the upper or handle end of the lever is confined within a guide usually formed in one

Fig. 267



MILLER PLATFORM AND HOOK.

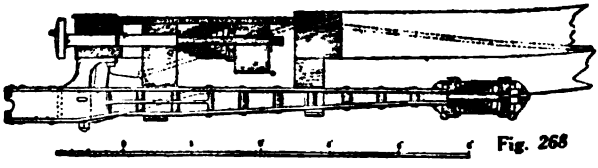


Fig. 268

MILLER PLATFORM AND HOOK.

piece with the railing, and which is shaped with several notches for the reception of the lever when it is desired to lock the hook in the uncoupling position.

On the opposite side is placed a cast-iron stop designed to limit the lateral motion of the hook

enough to prevent uncoupling. This casting is secured by a ⅞-inch bolt passing both through it and the end timber, and is maintained in its vertical position laterally by a ½ by 3-inch bent bar, which also does duty as a step for the brake shaft, and in the other direction by a brace attached to. one of the draw timbers.

To prevent uncoupling the hook has an inclined face, and in addition is acted upon by a two-leaf spring placed alongside of it, which is kept in place by the two carry irons, the second or back hanger, serving as a fulcrum; the spring is strained to any desired degree by a bolt and bracket provided for this purpose.

The main carry iron is attached to the under side of the truss beam by four ¾-inch bolts; its position is oblique and several inches from the center line, and on its proper dimensions and adjustment greatly depends the automatic action in coupling. In addition to doing duty as a support to the side spring, the back hanger serves as a safety hanger to the drawbar; it does not, however, carry the drawbar as long as all the parts are in proper repair.

The original form of the Janney platform and coupler are shown in Figures 269, 270 and 271. The principal member is a lever or combination yoke pivoted on a 1½-inch bolt, which is located a few inches above the draw-bar, and passes through the draft timbers, the holes in which are bushed with iron ferrules to guard against wear. The connection of the upper arm with the buffer equalizer and spring is effected through a 1¼-inch T bolt. As the buffers are intended to move outward whether the draw-bar moves in the same

or a contrary direction, the latter must be able to act in the first case on the portion of the yoke above the fulcrum, or the upper arm, and in the

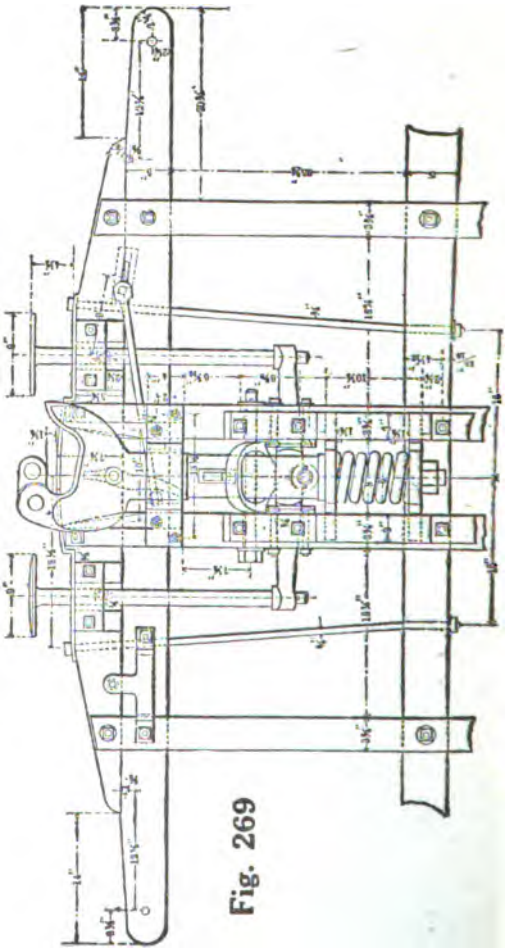


Fig. 269

JANNEY PLATFORM.

other case on the lower arm. The upper connection is made with a T bolt and post or horn fitted to a slot in the drawbar; the lower by simply

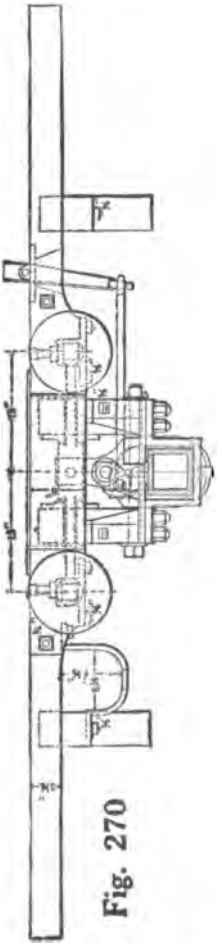


Fig. 270

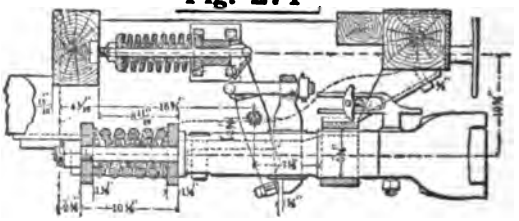
JANNEY PLATFORM.

bringing the yoke which surrounds the drawbar in contact with the protruding end of the post.

The buffers are two in number. They are retained by malleable iron guides let into and bolted to the end timber, and attached to the equalizer, by the use of which as flexible a connection as is obtained with a single buffer is insured. The equalizer is supported by the draft or main knee timbers, which are provided with suitable mortises and guides for that purpose.

The buffers and equalizer are either malleable castings or forged iron; the latter is usually preferred, because it is more reliable, and can be

Fig. 271



JANNEY PLATFORM.

produced at very nearly the same cost. The combination yoke is always a casting (malleable or steel.)

The construction of the platform itself is in the main not altered. A change is, however, made in the form and fastening of the end timbers, but not for the reason that any feature of the coupler or buffers requires this. It is composed of two separate pieces, one of which, the inner piece, is 3½ inches thick by 5 inches wide, and of the usual length; it rests on the knee timbers, which are cut down at the ends to receive it, and

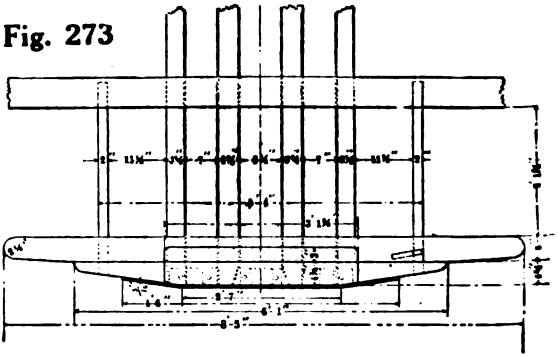
is secured to them by one ⅞ inch bolt through each, those passing through the main knee timbers also assisting to retain the drawbar carry iron. The outer piece is 6 inches thick for a distance of 3 feet, the remaining 1½ feet at each end being reduced to the same thickness as that of the main end timber. Its width is 6¾ inches at the center line, 5¼ inches where the buffers are attached, and tapering from those points to the ends. This timber is, like the first, fastened to the platform timbers with vertical bolts, to the draft timbers with the iron straps that cover the ends of these, and to the end sill by two ¾ inch rods.

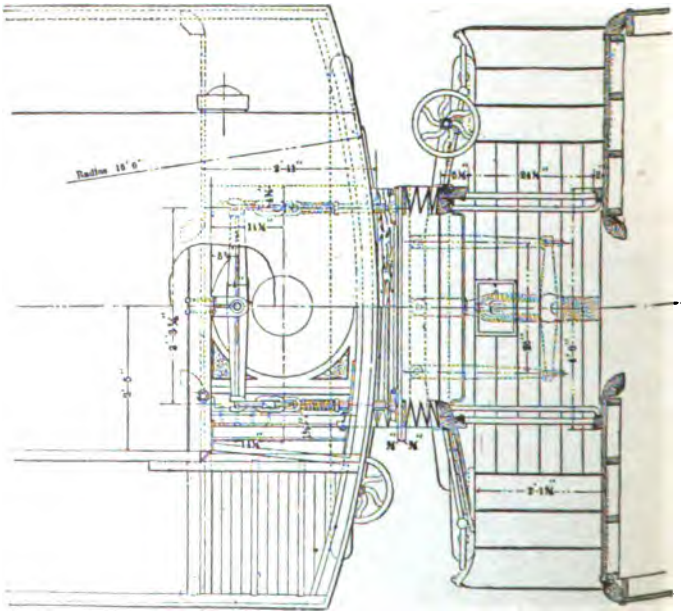
These two platforms were the first ones of their types. From them all the various modified devices have been derived. In their original form they are not now in very extensive use. A more modern platform framing and draw bar arrangement is shown in Figure 272.

Many passenger cars are now equipped with vestibules which are not only a convenience to passengers and others in passing from one car to another but have the effect of steadying the train by making it practically a continuous and solid structure. The vestibule, it is claimed, in addition to answering these purposes, decreases the resistance of the atmosphere on the train and also tends to obviate telescoping of the cars in the event of collision.

There are two kinds of vestibules in general use, known as wide and narrow. The narrow was the first to be used. Its doors enclose only the platform between the steps. The general construction of a narrow vestibule is illustrated in Figures 273 and 274.

Fig. 273





NARROW VESTIBULE.

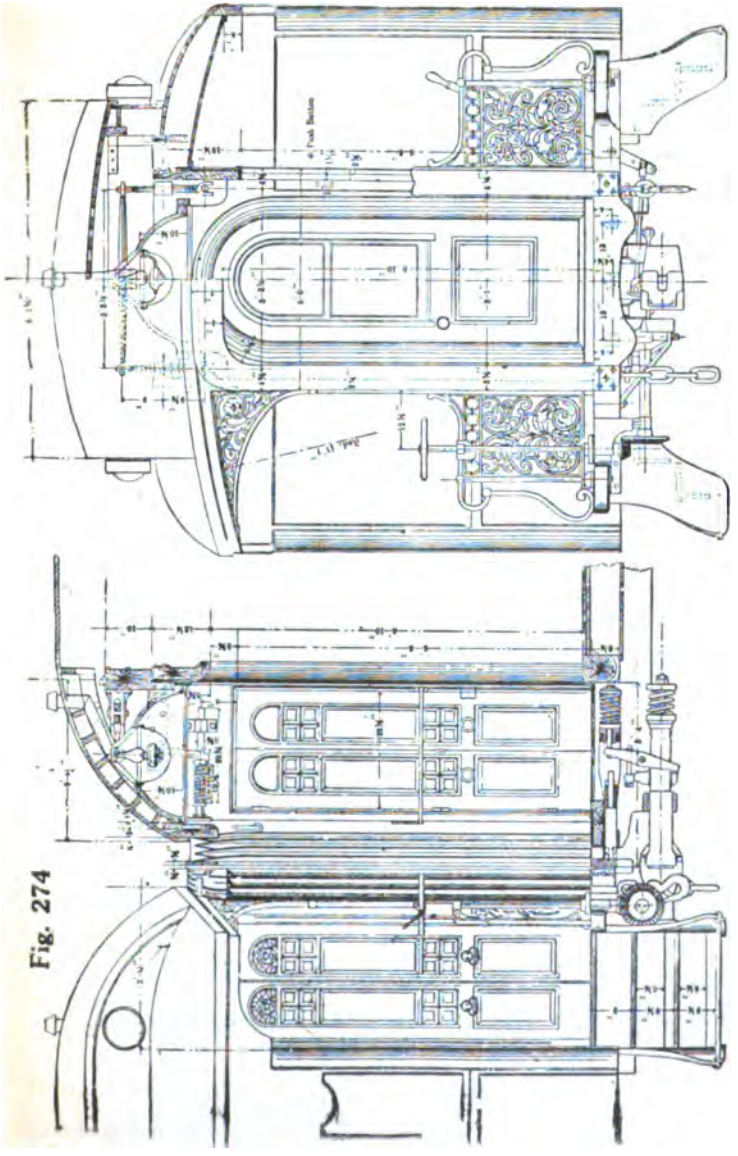


Fig. 274

NARROW VESTIBULE.

The platform on which the vestibule is located is strengthened by plating the platform timbers with iron, as shown; this, as well as the strengthening of the side frames of the body, is necessary to obtain the proper resistance to the strain produced by the friction of two vestibule or diaphragm plates in contact. Another change is the form and size of the buffers. These constitute practically the only changes required in the construction of the platforms and draw gears.

The buffer bars or stems are hinged to a cast steel plate, which takes the place of the ordinary buffer heads. They are hinged to permit adjustment on curves and a third stem, which is in the center of the plate is provided to take the strain when in contact with a car equipped with the ordinary Miller or single stem buffer. To close the opening between this buffer plate and the platform end timber, and thus make the platform continuous, a thin wrought iron plate which slides on a recessed plate of cast iron on the end timber is attached to the buffer head.

The so-called vestibule plate is in the form of an inverted U, the ends of which are attached to the buffer with rivets or countersunk headed bolts, the whole forming an opening which is 3 feet wide and nearly 7 feet high. Its face is planed. To obtain a practically dust and rain proof joint between a pair of these plates an arrangement of levers and springs is provided in the platform hood, the springs to give the desired compression, which is nearly equal to that of the buffers, and the levers to compensate for the angularity produced when the cars are on a curve. A single equalizer like that employed

for the buffer would answer the purpose if it were convenient to introduce it on a line with the points of attachment of the frame plate. The arrangement used consists of two bars or stems which are attached to the vestibule plate with ball and socket joints by means of suitable castings and are guided in boxes secured to the end carline and side walls of the vestibule. The spiral compression springs are located on these stems between shoulders formed on them and the ends of a pair of vertical levers which have their fulcrums on the side walls and whose upper ends are connected by short chains to the ends of a horizontal equalizer which in its turn is fulcrumed to a timber framed in above the end plate of the car. This cross-timber and the brackets forming the side walls of the vestibule are substantially and securely fastened with corner irons and bolts. The connection between the vestibule plate and the framing of the vestibule is made with heavy sheet rubber or canvas which is shaped like the folds of an accordian.

The ceiling of the vestibule is dome-shaped and is furnished with a lamp; there are also provisions for ventilation. The doors fold back upon themselves, so as to be less in the way when open. They are usually decorated, with bevel-edged plate glass and brass grills. All the attachments of the platforms are also very elaborate; the ornamented railings and brackets, brake wheels, etc., are of polished brass, and the floor and treads on the steps are covered with corrugated rubber mats.

The wide vestibule is of practically the same general construction as the narrow vestibule. The

exception being in the location of the doors. These are placed out practically flush with the sides of the car and the whole platform is then enclosed. Large panes of glass are used above the line of the window rail of the car, in both

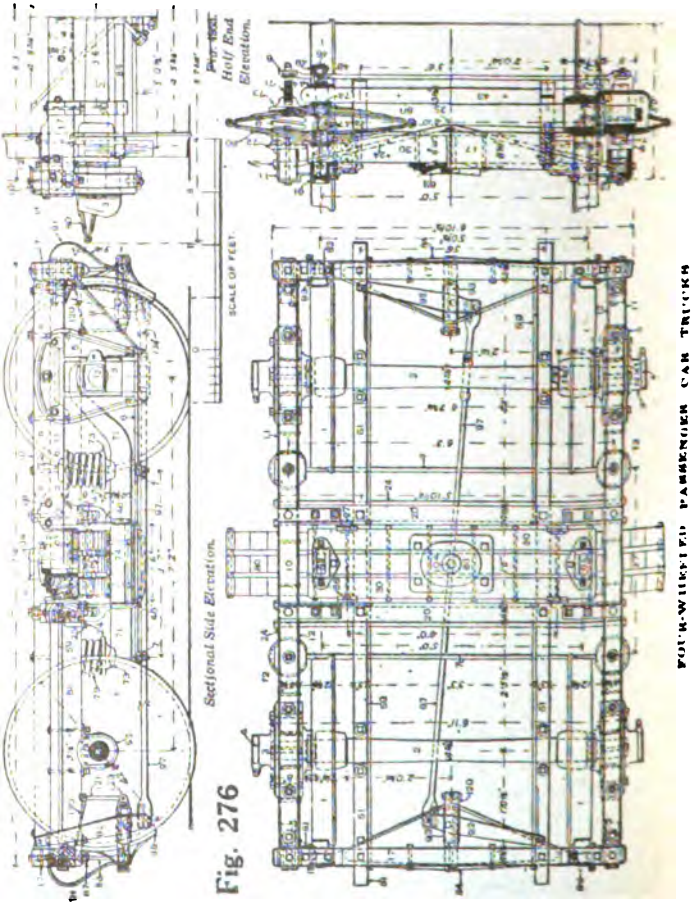


Fig. 276

FOUR-WHEELED PASSENGER CAR TRUCKS

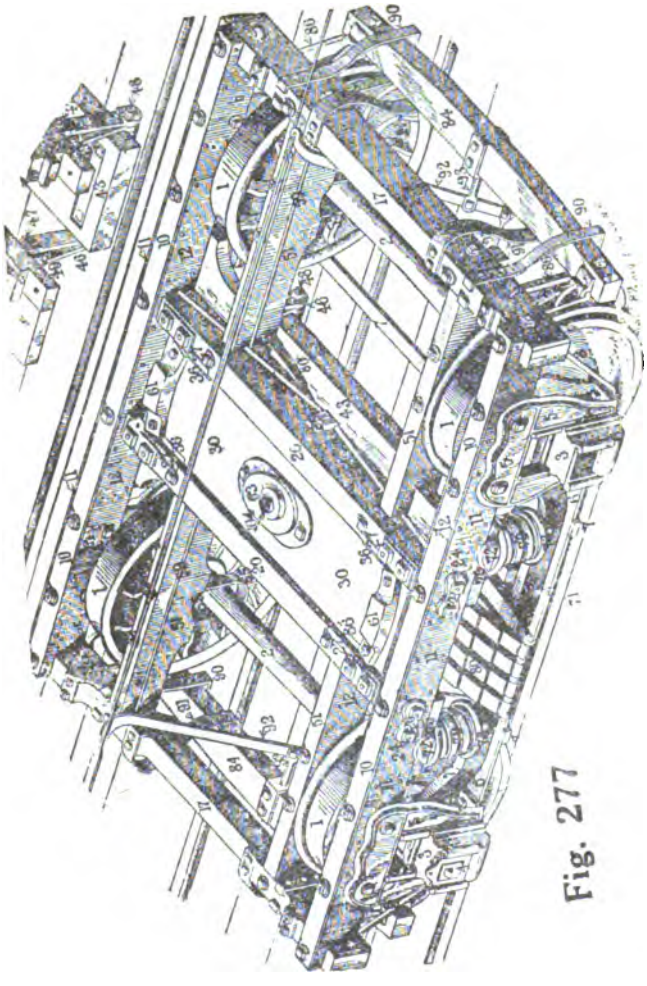
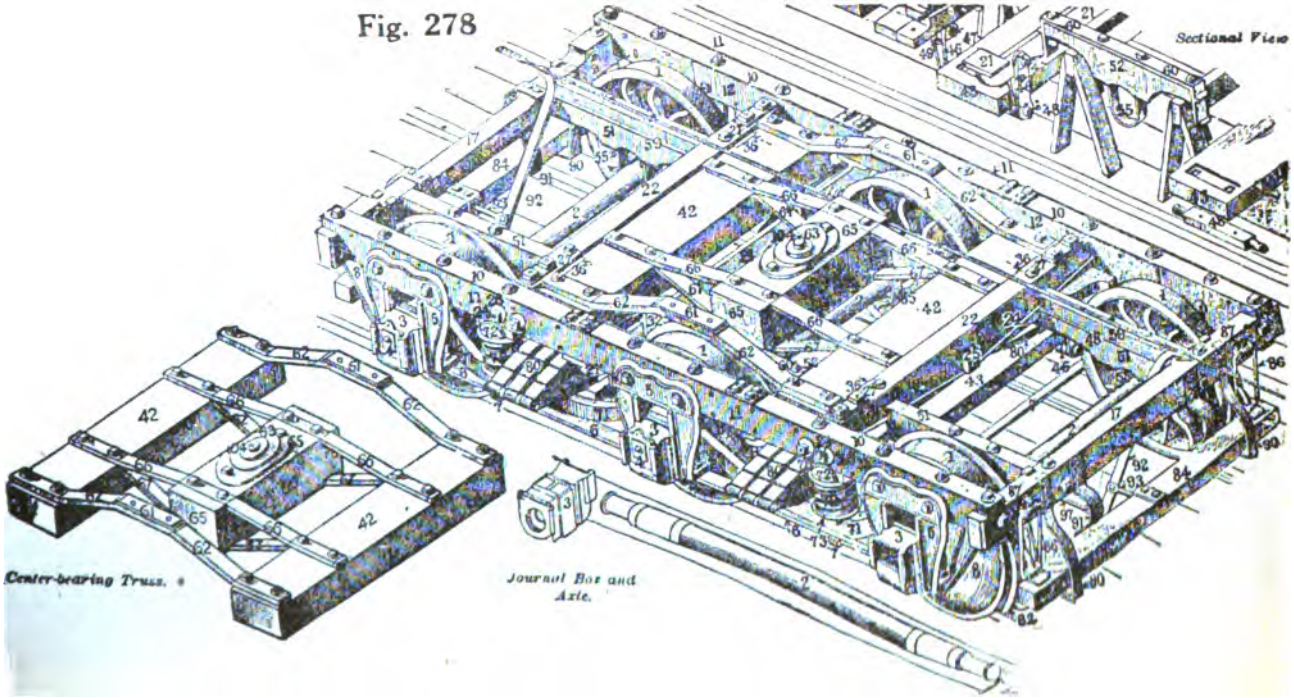


Fig. 277

PERSPECTIVE VIEW OF A FOUR-WHEELED TRUCK.

Fig. 278



A PERSPECTIVE VIEW OF A SIX-WHEELED TRUCK.

the side doors and the end framing of the platform. Trap doors let down flush with the floor of the platform and cover the openings over the steps behind the side doors.

The trucks used on passenger cars differ from those used on freight cars, being as a rule more elaborate. The four and six wheel types are illustrated in detail in Figures 276, 277, 278.

Following is a list of names of parts of passenger car trucks indicated in the foregoing illustrations:

1. Wheel.
2. Axle.
3. Journal-box.
4. Journal-box lid.
5. Pedestal.
6. Pedestal Tie-bar.
7. Pedestal Stay-rod.
8. Pedestal-brace.
8¹ Pedestal-brace Tie-bar.
10. Wheel-piece.
11. Outside Wheel-piece Plate.
12. Inside Wheel-piece Plate.
13. Wheel-piece Truss-rod.
14. Arch-bar.
15. Inverted Arch-bar.
16. Auxiliary Arch-bar.
17. End-piece of Truck-frame.
20. Transom.
21. MIDDLE TRANSOM FOR SIX-WHEELED TRUCK.
22. OUTSIDE TRANSOM FOR SIX-WHEELED TRUCK.
23. Transom Tie-bar.
24. Transom Truss-rod.
25. Transom Truss-block.
26. Transom Truss-rod Washer.
27. Transom Chafing-plate.
28. Transom-casting.
29. Transom-pillar.
30. Truck-bolster.
36. Truck-bolster Chafing-plate.
40. Lateral-motion Spring.
41. Lateral-motion Spring-pin.
42. SPRING-BEAM.

43. Spring-plank.
44. Spring-plank Bearing.
45. Spring-plank Safety Strap.
46. Swing-hangers.
47. Upper Swing-hanger Pivot.
48. Lower Swing-hanger Pivot.
49. Swing-hanger Pivot-bearing.
50. Swing-hanger Friction-block.
51. Safety-beam.
52. MIDDLE SAFETY-BEAM.
53. Safety-beam Block.
54. Axle Safety Bearing.
55. Axle Safety-strap.
56. Axle Safety-bearing Thimbles.
59. Safety-beam Tie-rod.
60. SAFETY-BEAM IRON.
61. Truck Side-bearing.
62. SIDE-BEARING BRIDGE.
63. Truck Center-plate.
64. Center-plate Block.
65. CENTER-BEARING BEAM.
66. CENTER-BEARING ARCH-BAR.
67. CENTER-BEARING INVERTED ARCH-BAR.
68. Check-chain.
69. Truck Check-chain Hook.
70. Truck Check-chain Eye.
71. Equalizing-bar.
72. Equalizing-bar Spring-cap.
73. Equalizing-bar Spring-seat.
74. Bolster Spring-seat.
75. Bolster Spring-cap.
76. Spring-block.
78. Journal-spring.
79. Equalizing-bar Spring.
80. Bolster-spring.
81. Truck-frame Knee-iron.
83. Brake-head.
84. Brake-beam.
85. Brake Eye-bolt.
86. Brake-hanger.
87. Brake-hanger Carrier.
88. Brake-beam Safety-chain.
89. Brake Safety-chain Eye-bolt.
90. Brake Safety-strap.
91. Release-spring.
92. Brake-lever.
93. Brake-lever Fulcrum
94. Brake-lever Guide.
95. Brake-lever Stop.

96. Brake-lever Sheave.
97. Lower Brake-rod.
98. Brake-shoe.
104. King-bolt or Center-pin.
112. Journal-bearing.
114. Stop-plate.
115. Dust-guard.
120. Brake-beam Adjusting-hanger Carrier.
121. Brake-beam Adjusting-hanger.
123. Brake-beam Adjusting-hanger Clip.
124. Brake-beam Adjusting-hanger Plate.
130. END-SILL CORNER-PLATE.
131. TRANSOM CORNER-PLATE.

Names of parts in capital letters in the foregoing list are special to six-wheel car-trucks.

CHAPTER XV.

THE USE OF STEEL IN THE CONSTRUCTION OF PASSENGER CARS.

While, as we have seen, the use of steel in the construction of freight cars, in fact almost their complete construction of this material, has become popular, the same cannot be said of passenger cars in America; indeed steel has been applied to passenger cars in a very limited way. Perhaps, a reason for this may be found in the fact that in the case of the passenger car its development has been left almost entirely to car manufacturing companies and not with the railways themselves. The direction of improvement has been along the lines of decoration and luxury in internal arrangements rather than strength in construction or increase of capacity in proportion to dead weight.

Those who advocate the free use of metal in the construction of passenger cars claim that the universal adoption of this method would tend to the lightening of the dead weight hauled, would render the equipment less liable to destruction by fire and make the train as a whole more symmetrical in strength throughout its length. Thus there would not exist the necessity of placing strong and heavy cars such as sleepers, diners, parlor and private cars, which are of excessive weight when built of wood, in the same train with light coaches, which in the event of

collision are menaced with destruction by the heavier vehicles. Such advocates still further claim that the use of steel freight equipment imposes a necessity for stronger passenger equipment because of the increased risk due to the presence of heavy loaded steel freight cars on the same or adjoining tracks.

The question of the development of the passenger car along the lines of strengthening the vehicle without unduly adding to its weight is one of extreme interest. If the analogy of the freight car counts for anything it would seem that the solution of the problem will be found in the ultimate adoption of steel as the principal material of construction. An eminent authority on car construction has the following to say on the subject:*

Some of the reasons which have made steel construction successful for high capacity freight cars will also apply to passenger equipment when the length of the span becomes the important element instead of carrying capacity in tons. A study of the comparative efficiency of wood and steel for a structure like a seventy-foot passenger car may be made by reference to the diagrams, Figs. 279 and 280, showing the usual construction in wood, and a proposed section for a steel passenger car frame. It is often claimed that for equal weight wood is as strong as iron or steel, and for ordinary rectangular beams this may be true, but it is not correct when steel is disposed in the shape of a deep plate girder with a thin web and heavy flanges. In this way a large moment of inertia and a high moment of resistance is obtained per unit of weight, which can not be secured in wood, as there is not room enough in the space available in car construction for the volume of wood required. To illustrate this we may take the section of the side of a wooden car below window sills as equivalent to a solid beam 4 inches thick by 28 inches deep, and the weight of a cubic foot of Norway pine 40 pounds per cubic foot. The weight of steel being 480 pounds per cubic foot, the ratio of weight of pine to steel is 1 to 12. The ulti-

*William Forsyth.

mate strength of pine may be taken as 4,000 pounds per square inch, and of low carbon steel 50,000 pounds, the ratio being

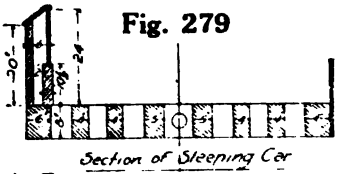


Fig. 279

Section of Sleeping Car

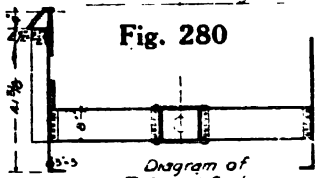


Fig. 280

Diagram of Proposed Section For Steel Passenger Cars.

about the same. The strength of the sections will be proportional to their moments of resistance. Now—

$M = fs$.

f = safe unit load = 1,200 pounds for Norway pine.

S = Section modulus.

$$S = \frac{bh^2}{6} = \frac{4 \times 28^2}{6} = 523, \text{ for wood beam.}$$

$M = 1{,}200 \times 523 = 627{,}600$ inch pounds.

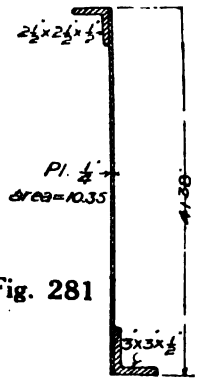


Fig. 281

STEEL GIRDER.

For the steel section, taking 16,000 pounds per square inch as outside fiber stress in tension at lower flange and 10,000 pounds unit stress in upper flange, the moment of resistance is found as follows:

Section modulus top flange $Sc = 160$.

Section modulus bottom flange $St = 172$.

$\therefore$ $Mc = 160 \times 10{,}000 = 1{,}600{,}000$ inch pounds,

and $Mt = 172 \times 16{,}000 = 2{,}752{,}000$ inch pounds.

The top flange being the weaker, its value of M will govern and

$$\frac{1{,}600{,}000}{627{,}600} = 2.54$$

Which shows that this particular steel girder is more than 2½ times as strong

as the assumed wooden one. The wood section one foot long weighs 31 pounds, and the steel section 52 pounds. The comparative strength for equal weight is therefore 1 to 1.5 in favor of steel.

In order to develop this idea into a complete plan for a coach of modern dimensions with steel underframe and much of the body of steel, I secured the co-operation of Mr. George I. King, general manager and vice-president of the Middletown (Pa.) car works, and who has had a large experience in the designing of steel freight cars and steel underframes for interborough electric cars. Mr. King's design is shown in general plan, Fig. 282, and details in Figs. 283, 284, 285 and 286.

It will be seen that the side of the car below the windows is formed of a deep steel girder made of ¼-inch plate, 41⅜ inches deep with 2½ by 2½ by ½-inch angles at the top and 3 by 3 inch by ½ inch at the bottom. The center sills are made of 12-inch channels, 25 pounds per foot, with lattice bracing and flange plates 6 inch by 1 inch on the bottom and ½-inch plates 24 inches wide on top. The posts between the windows are made of 6-inch channels which extend from floor to roof. The longitudinal plates are 6-inch Z bars, 15.6 pounds per foot, and steel carlines connect these for the upper deck. The whole outside and ends of the car, except the windows and doors, are made of ¼-inch steel plates with rivet heads plainly showing. The center sills and side sills are connected by 7-inch channels 12¼ pounds per foot, and the body bolsters are quite similar to those used in steel freight car construction. The end corner posts and the end door posts are formed of 10-inch channels, 15 pounds per foot, bent to a quarter circle. Some of these features, in connection with the Z-bar plates and the end posts, have been patented by Mr. King. The whole side of the car is a compound steel girder made up of the deep plate girder below the windows, with numerous posts riveted to it, and a stiff side plate connecting them at the top, the whole construction being tightly bound together. It is probable that the first cost and the weight of a car of this design will be somewhat greater than the regular wooden coach, but from the experience gained in building such cars it is believed that with a steel car of somewhat similar construction, having the advantage of pressed steel forms wherever possible, and such improvements as are always developed in actual construction, a cheaper and lighter car can be built by the use of steel which will be stronger in resisting the force of collision and practically fireproof. The steel passenger car will thus be developed by experience in construction, by a display of ingenuity in designing efficient details, and the adaptation of fireproof materials to a simpler inside finish.

It will be seen that all the large timbers are removed and

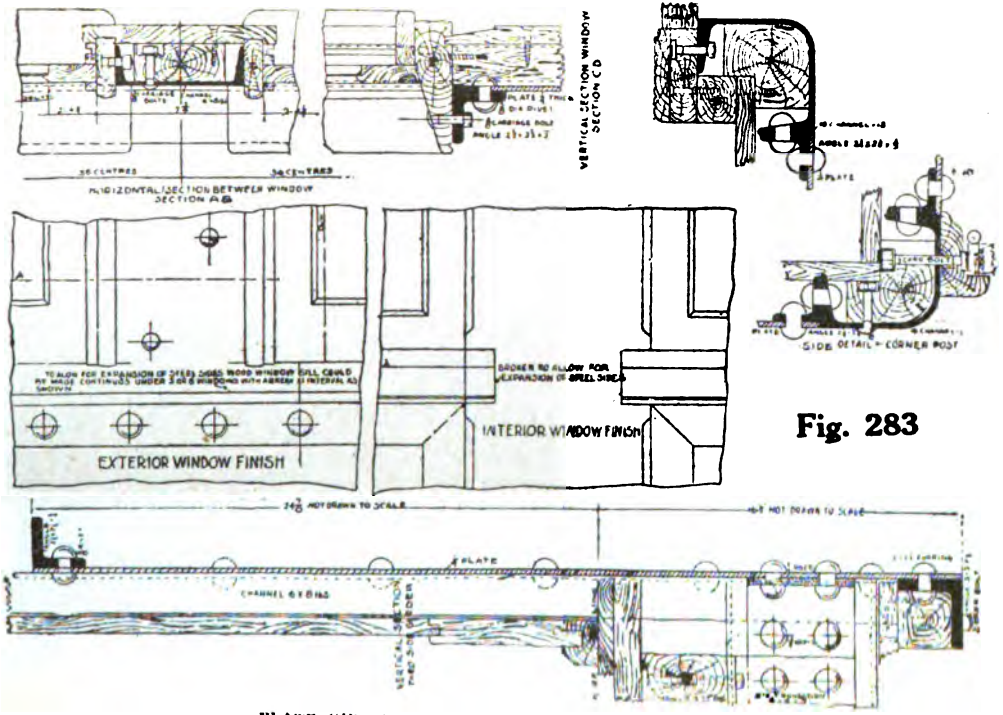


Fig. 283

PLATE GIRDER, SIDE SILL AND CHANNEL IRON POSTS.

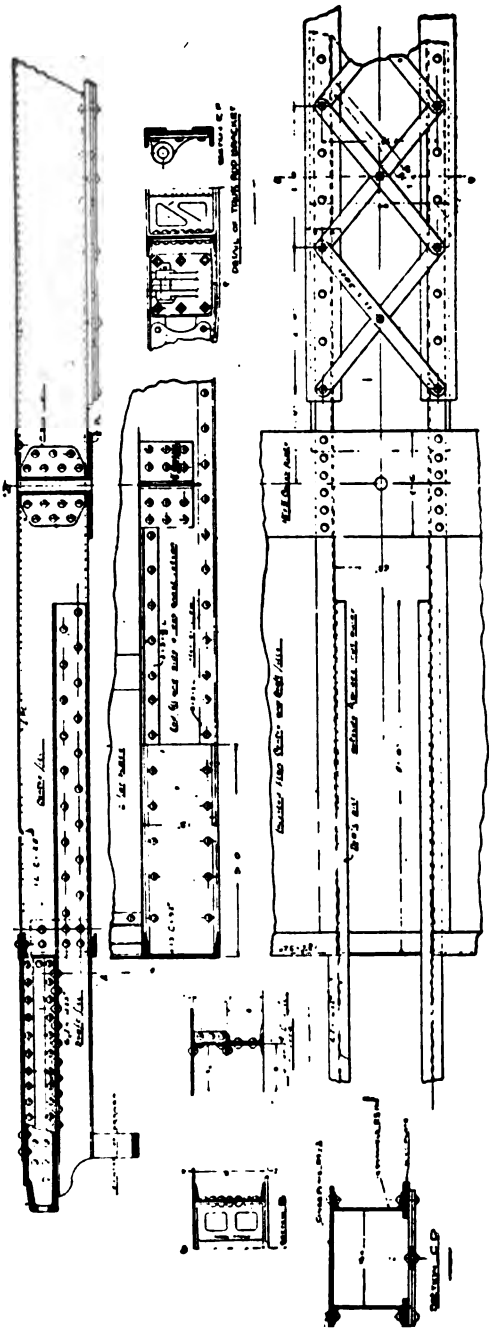


Fig. 284

CENTER SILLS AND DRAFT TIMBERS.

the floor can be made entirely fireproof. The quantity of wood in the car body is very much reduced and the small sections could easily be made fireproof. It is desirable to

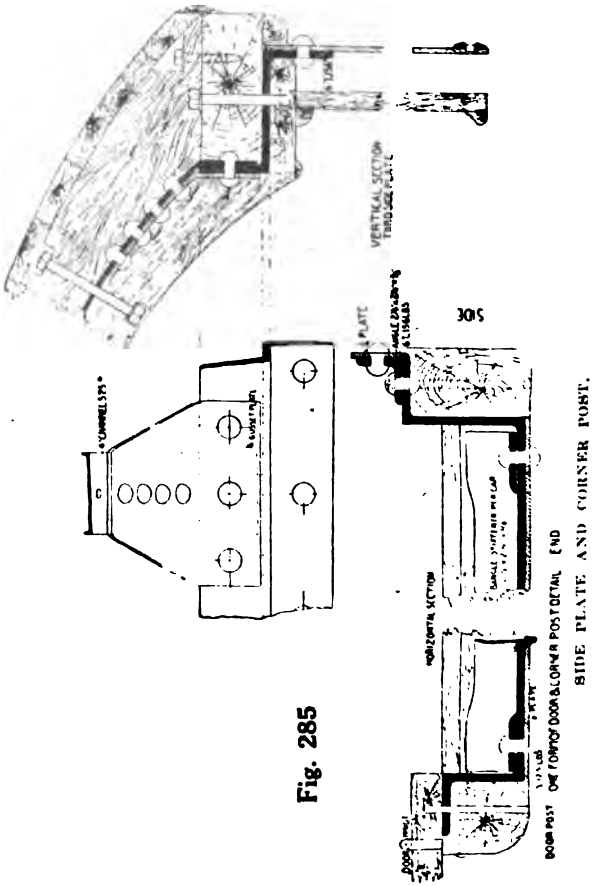


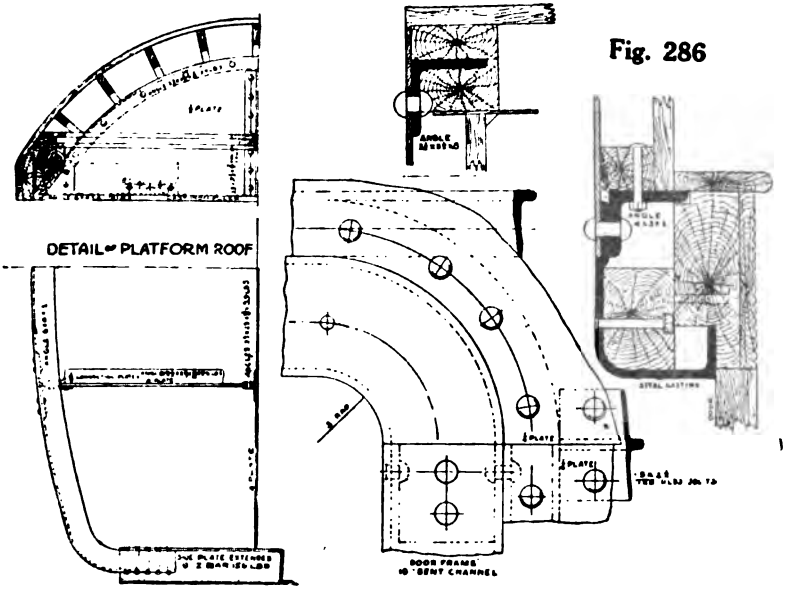
Fig. 285

have wood or an equivalent non-conductor on the inside of a steel car of this or almost any other construction, not only for inside finish but as a non-conductor in order to make the

interior comfortable in hot or cold weather and to prevent noise.

Practically all the development of the use of steel for passenger cars has been along the lines of substituting steel for wood in a car constructed on the lines of our present cars. In using steel

Fig. 286



PLATFORM ROOF AND DOOR POST.

there is of course a great opportunity to use the super-structure as an aid in strengthening the car. The present style of clear story does not lend itself very well to steel construction and it would seem as if some new arrangement of the roof structure would be developed as a result of the tendency to use steel in place of wood.

The mail cars have received the attention of a great many government and railway officers with the view of making them as strong and stiff as possible. Regulations have been adopted which require that the side sills, the center sills, the end and corner posts, the end plate and several of the side posts near the ends of the car shall be reinforced by iron or steel plates. This makes a very stiff car. However it can be anticipated that the complete use of steel for passenger cars will be introduced on cars in the mail and express service. Already one road, the Erie, has brought out a complete steel car of this type. Its performance will be carefully watched and its successful service will no doubt be the fore-runner of many other steel passenger cars.

CHAPTER XVI.

PAINTING CARS.

All cars are painted with the primary object of protection. The coloring of the paint is a secondary consideration. It is chosen on the strength of its durability or color retaining properties and its attractiveness. Paint, as is well known, is a mechanical mixture of a pigment and a carrying vehicle. After being spread over the surface to be covered this vehicle drys or hardens and, with the pigment held in suspension, it forms a coating which protects the painted part from the deteriorating effects of the weather. This coating presents a smooth, impervious surface to the elements and thus excludes the moisture which is the principal cause of the decay of wood and the rusting of iron or steel.

In general there are four qualities of a good paint for use on railway cars. First, durability; second, covering power; third, drying qualities; fourth, ease of application. These all apply to paints used both on passenger and freight equipment. By durability of course is meant its ability to withstand the effects of all sorts of exposure at the same time retaining its original color. Covering power refers both to the amount of surface over which a given quantity of the paint can be spread and also to its ability to thoroughly hide the ground color or unpainted surface to which it is applied. Drying qualities

refer to its ability to harden or dry more or less rapidly. Ease of application means the ease with which it can be spread over the surface to be painted without leaving heavy streaks and rolled up or hardened pieces.

Naturally the best paint is one which will retain its color longest, withstand the exposure best, spread over and thoroughly cover the largest surface and at the same time dry reasonably quickly as well as spread out easily when being applied. No one paint excels in all these qualities. The choice of a paint then depends on a careful analysis of the conditions of the service and the facilities for applying the paint. A paint that has durability, can be easily applied and spreads well, can be made to dry quicker by the addition of special preparations called "driers." The usual vehicle in paint does not dry by evaporation alone. The absorption of oxygen from the atmosphere sets up a chemical action which changes the vehicle into a somewhat resinous state throughout which are held the particles of the pigment. This oxidization is often assisted by these driers which act on the oil, as a ferment, causing a more rapid absorption of the oxygen.

In the painting of wooden freight cars a linseed oil paint is used the same as for house painting. The particular color of the paint is a matter of the personal opinion of those in charge of the car department as well as the desire of the freight department of the road. For a long time many roads endeavored to keep their cars distinctive by using a coloring peculiar to their equipment. One road would paint the entire body of the car with a "catchy" or "gaudy"

color; another would make their particular "catchiness" appear in the color of the side doors; still another would have a wide band all around the car painted in an odd color, while still another would paint the ends in a different shade or color from the rest of the car. A few roads still retain this practice but by far the larger number are painting the bodies of all freight cars with a dark red or brownish mineral paint. Three coats of paint are usually called for, the first of which is applied directly to the wood which has been surfaced in the mill before erecting. At least twenty-four hours should elapse between the application of each consecutive coat. The most durable results are obtained when each of these coats is applied with a brush. However some few roads make a practice of spraying on the first two coats. Others spray one coat and call for only two in all. In every case though the last coat is brushed in, as it seems to bind the paint better and leaves a smoother and glossier finish than the spraying process. As explained, to this smooth finish is due the durability and protecting qualities of the paint.

After the last coat of the body color is applied and has had time to dry the lettering and "blacking off" is done. "Blacking off" consists in painting with black, usually an asphaltum paint, all the exposed metal used on the body of the car, such as rod ends; corner bands; door hangers; locks, stops, rails, etc.

The lettering and special marking are sometimes outlined by the use of pounce patterns. These patterns are made of thick paper on which is drawn the outline of the letter or device it is

desired to transfer. Small holes are then cut through the paper at short intervals along these lines. When the pattern is held against the car and the powder brush is rubbed on it, a little of the powder passes through each hole, which leaves on the car a very plain outline of the figure. With this as a guide the figure can then be readily painted in. Two coats of paint are ordinarily called for when this method is used. Another way to put on the lettering, cheaper and as satisfactory, is to use a pattern out of which the complete figure is cut. With this a "dauber" is used in place of a brush. As a consequence of being able to use a thicker paint with a "dauber" than with a brush only one coat is ordinarily required. These patterns are made of heavy paper or a thin sheet metal. The latter is more satisfactory as the centers of the letters can be held rigidly in place by small wires soldered across the openings, while with the paper patterns the figures can be cut out only in skeleton and a brush is needed to finish up the letters where the binding pieces are left across the openings.

Besides the painting of cars which is visible from the outside there is considerable painting done during construction which is entirely covered up. All mortised and tenoned joints, butting joints of posts, braces and sills, the top and outside faces of side and end sills, the top and outside faces of side and end plates, all woodwork against which metal is placed, etc., receive a heavy coat of either a mineral or creosote paint. Paint is also applied to the ends and edges of all roof boards before they are laid. When a double board roof is used the top of the first course is

thoroughly painted before the second course is laid. All painting which is finally covered up is invariably done with a heavy or thick paint, a precaution which results in saving the wood, thus giving a longer life to the car.

The most satisfactory way to paint metallic roofs where the metal is exposed to the weather is to give it three coats of a good mineral paint. Galvanized iron will not take paint readily but if the first coat is made thin and is well brushed out it will aid materially in the life of the paint. The paint will invariably crack off in time when exposed to alternate heat and cold due to the fact that the iron and paint expand and contract differently. The only remedy is to re-paint.

The painting of the iron and steel in the trucks is of the plainest kind. A single coat of a good steel protecting paint is used, preferably an asphaltum paint.

The painting of steel cars has presented a field for investigation during recent years. As yet no definite standard practice is in use. There are many advocates of as many different processes. The chaotic condition of this subject is due to the fact that all-steel cars have not been in general use long enough at this date to get final proofs as to what is the best material to use in painting and what is the best way to apply it. However it is generally admitted that it is absolutely necessary to have the steel plate perfectly clean before applying any paint or oil. All rust and mill scale must be removed. There are several ways of accomplishing this. Some use wire brushes, others scrape the surface with a sharp edged tool, still others use a sand blast and some use only a hammer.

As to the character of the paint in general use there is, as mentioned, no standard. Pure graphite paint, carbon paint, red lead, and lampblack in oil are used besides the many patented paints now being sold for this special service. Some roads have discontinued the use of any paint on its steel cars. Two coats are applied by some people; others require three. The use of the brush and the spraying machine for applying the paint seems to be about equally divided. The brush is preferred for the first coat and the sprayer for the following coats by some. Others use the sprayer only at seams and such places where the brush will not conveniently get the paint thoroughly into the small corners and cracks. As a result of a close investigation of the practices in vogue a special committee of the Master Car Builders' Association suggested to the Association in 1904 the following method:

First—The steel should be thoroughly cleaned of all rust and furnace scale before the car is assembled.

Second—All joints before assembling should be thoroughly coated with coal tar.

Third—After car is assembled, all grease should be thoroughly removed from the steel, and same given a good coat of carbon or graphite paint on the outside and underneath, and on the inside a heavy coat of crude petroleum, coal tar applied hot, or some similar substance.

Fourth—The outside to be given a second coat of graphite or carbon paint as may be desired.

They especially deprecated the allowing of cars loaded with soft coal to stand a long time with the load in same.

With the best of attention paid to each step in the process of protecting steel cars it is found on an average that about once in thirty months a car should be cleaned off and repainted. In some cases this time is much shorter. Under certain conditions of service the cars begin to rust through the paint after about eighteen months' use. The seams and joints are the first points to show signs of corrosion and it is here that special care should be exercised when the car is originally painted.

In the painting of passenger cars a much greater refinement is necessary for the exposed parts of the car both inside and out, than is practiced on the freight equipment. During the construction of the car the same attention is given to painting the joints, etc., as outlined for freight cars. It is to the exterior that the painter has to give his careful attention. While painting freight cars he has to beware only of frost and rain. A variation of the temperature does not materially affect his work and any amount of moisture less than a rain appears to make little difference in the appearance of the cars. With passenger cars this is entirely different. An even temperature and a dry atmosphere are almost essential to perfect results. As a consequence especial buildings are prepared for painting this class of cars. Elaborate arrangements are made to keep the temperature steady and evenly distributed. The aim is to keep the room at 70° Fahrenheit. An excess of moisture is also avoided, care being taken to thoroughly drain away the wash water used in scrubbing down the cars.

Instead of using a simple linseed oil paint the

paint is made up with considerable spirits of turpentine and "japan drier" in the vehicle. This is made necessary by the finish that it is desired to obtain. An oil paint will not entirely obliterate the graining of the wood and the finishing varnish that is used cannot be successfully applied over an oil paint. The complete obliterating of the grain of the wood gives the background for the beautiful finish that is so distinctive of passenger cars. The varnish that is finally applied is the real protective coating and to it is due, with slight qualifications, the durability of the paint. These qualifications consist simply in requiring that the surfacing coats are properly prepared and applied, and that the varnish itself is up to the proper grade. With these conditions satisfied the car should be prepared so that with occasional varnishings and patchings it will last from eight to ten years before the paint will have to be entirely removed and a new foundation coat applied.

There are four distinct parts in the painting of the exterior of a passenger car: first, the preparation of the wood; second, the surfacing; third, the application of the body color and markings; and fourth, the finishing with the varnish covering.

To begin, the car must be carefully sand papered and then dusted. All grooves and corners must be thoroughly cleaned as well as all flat surfaces. It is then ready for the surfacing which consists in applying first a priming coat, then the "rough stuff" and finally, after puttying and glazing, rubbing down to a smooth surface with sand paper alone or pumice stone and

water. The body color is then applied, the requisite number of coats being determined by the nature or kind of color chosen. An opaque pigment will naturally call for fewer applications than one which is more transparent or does not possess good covering qualities. Usually three coats will answer, twenty-four hours being allowed between coats for thorough drying of each. When the last coat of body color is dry the car is ready for the lettering and striping after which the finishing varnish is applied. The lettering is always outlined by pounce patterns and is worked in with a brush. Sometimes the letters are only painted a distinctive color, at other times gold, silver or aluminum leaf is used which adheres to the outlined letter that has previously been marked in with gold size japan. These practices apply also to the marking and striping.

Three coats of varnish are always used with forty-eight hours between each. Then after at least seventy-two hours' time allowed for final complete drying the car is ready for service.

In following this general scheme of exterior coach painting there are two general methods used. They are the oldest, called the lead and oil method and its opposite, in which the use of lead is entirely dispensed with. There are strong advocates of both systems who give both technical and practical proofs of their faith. However it is sufficient to say that there are good grounds for using either method.

In painting a car by the lead and oil method it is first primed with a mixture of "keg-lead," raw oil, turpentine and japan drier, the proportions

of each being varied to suit the tastes and experiences of the Master Painter. After seventy-two hours the second coat can be applied. It is made up of the same ingredients with a little coloring added. This coat requires about forty-eight hours to dry before the puttying and glazing can be done. The putty used is naturally a hard drying putty. All nail holes are well filled with this, a putty knife being used to press it into the recesses. A little putty is left projecting above the level of the surrounding surface, as an allowance for shrinkage. In cases where wood of a resinous nature is used for such places as corner and door posts an application of a coat of gum shellac dissolved in alcohol is made either directly on the wood or over the coat of priming, which should have as little oil in it as possible. When coarse or open grained woods are used such as walnut, oak or ash a thin putty or glazing is pressed or scraped into the pores with a broad-bladed knife called a French scraper. This is ordinarily done over the second priming coat at the same time as the puttying of the nail holes.

After about sixteen hours or when the putty has hardened, three or four coats of a surfacer or "rough stuff" are applied twenty-four hours apart. This "rough stuff" is a mixture which must possess toughness and cohesiveness to prevent cracking. It must also be hard and totally non-absorbent of water, consequently it cannot be porous in the slightest degree. Its constituents are selected according to the personal experience of the painter in charge. Often a prepared compound can be advantageously used. A guide coat or thin paint of some color distinct-

ively different in shade from the rough stuff is at times used over the last application of rough stuff to assist in locating the uneven spots. The rubbing down of the rough stuff with pumice stone and water is an art which is acquired only by considerable practice. It must be carefully done so as to avoid scratching or rubbing too close. After completion the car is washed and dried with chamois skin. It is then allowed to dry off thoroughly.

In order to avoid the liability of accidents to the work from water being absorbed by the rough stuff during the process of rubbing down as outlined above a great many painters use a putty instead of the coats of rough stuff. This is applied with a French scraper to all flat surfaces. All the open grained wood is glazed at the same time. After drying for twenty-four hours it is sand papered down smooth.

The processes just outlined apply equally as well to the system of painting when white lead is eliminated. The primer and rough stuff are mixed without the use of white lead; they are applied in the same way and are rubbed down with pumice stone and water or sand papered after glazing instead of using rough stuff the same as explained for the lead and oil method.

Following the surfacing the body color is applied, the striping and lettering is done, which is followed by the three coats of finishing varnish.

It ordinarily takes about eighteen days to paint the exterior of a car when the glazing and sand papering method is followed. Twenty-eight days is the time required when the rough stuff is rubbed down with pumice stone and water.

The painting of the interior of a car is now being done in the plainest way. All wood work is finished in its natural color. It is carefully sand papered and dusted after which it receives its protecting covering of oil and varnish. When the head lining is made of veneer it is treated the same as the rest of the interior wood finish. At times it is painted a flat color on which some simple gilt striping is done, after which it is varnished. If the head lining is made of cloth it has to receive special attention. The piece of cloth cut to the proper size is stretched on a frame. It is then treated to a paste filler, after which a ground work of a lead paint is applied. Sometimes two coats are used before the design and final color is applied. After drying the head lining is then put in place on the car and finally treated to the finishing coat of varnish.

The ends of cars are usually damaged a great deal by the cutting action of the cinders from the locomotive. This is especially the case with cars that are habitually run in the train close to the locomotive. As a means of protecting the paint covering as well as the wood itself, the ends are sometimes sanded. This sanding consists in throwing a sharp fine sand on the fresh paint before it is dried. The sand adheres to the paint and thus forms a hard gritty covering which is not so susceptible to the action of the cinders. Of course the finishing coats of varnish are not applied to this sanded portion of the car.

The roofs are painted according to the covering used. If a canvas roof is used with copper flashings the roof boards are painted with a heavy coat of white lead before the canvas and copper

are laid. Then after the canvas is fastened in place another coat of the white lead is painted over it. After this is thoroughly dry it is given two coats of a linseed oil mineral paint, the color suiting the shade used on the sides. The metallic portions of the roof covering over the hoods at each end of the car are usually sanded the same as outlined above for the ends. With tin roofs, the tin, after being laid in place, is painted with a linseed oil paint, ordinarily three coats being applied, the first of which is "flat" or very thin and well brushed out.

The trucks of passenger cars do not receive the careful attention that the bodies do. This is natural because any attempt to make a fine finish would not be justified on account of the conditions of their service. With the dust, dirt and oil all over them a paint covering is needed that will stand the service and still have a clear appearance when washed or rubbed off. A plain linseed oil and mineral paint is used, a single coat being applied after priming with a lead and mineral primer. At times the trucks are striped for the appearance, a coat of varnish being finally applied to them. This same finish is given to the platforms and steps of the car.

Platform sills (if of steel construction), truss rods, queen posts, brake rigging, draw bars and all exposed metal parts of the car are painted with an asphaltum paint and finally the steam, air brake and air signal hose couplings are painted. The first two receive a coat of black asphaltum paint and the last is painted red as a distinctive mark.

BOOK II.

THE CAR SERVICE DEPARTMENT.

INTRODUCTION.

Cars and Men.

The Cars of a railroad are like the pockets in which men carry their wealth. If the pockets are full, the owners wear fine raiment, live sumptuously and wax fat; on the other hand if empty, their cheeks are hollow, their coats shabby and they carry about with them, withal, a creaky, hungry cough, that suggests the undertaker and the scrap heap.

Empty cars are like an empty stomach—they afford no nourishment to the body. On the other hand, full cars like a well nourished stomach, mean vigorous life with plenty of good red blood coursing through the system; and cars, like men, need plenty of exercise—but on full stomachs. Idleness in their case is what idleness is to men—waste, impoverishment, decay, premature death.

It is the province of those who look after the traffic of railroads to see that loads are provided for cars; and it is the duty of those who supervise the movement of equipment to see that it renders the maximum service with the least outlay and waste possible.

CHAPTER I.

Distribution and Use of Cars—The Car Service Agent.

The cars of a railroad are the receptacles in which its earnings are nourished. If delay occurs in filling these, or the supply is insufficient, or fails to nourish the system, the result is a breakdown, loss of vital force, perhaps bankruptcy.

It is with freight cars as it is with locomotives in regard to supply and demand. No railway can keep in the service sufficient vehicles to supply the maximum demand there will be on particular days, or during the rush season which attends the business of every carrier. The most it can do is to meet reasonable requirements. When business is normal little difficulty is found in supplying promptly, the demands of shippers. But when business is extra urgent, when the public clamor for cars, then the ingenuity of those in charge is taxed to the utmost to meet requirements, and so apportion the supply available as to satisfy the reasonable requirements of the public and gain the greatest revenue to the carrier with the least outlay incident thereto.

Railroads are built to do business; to make money, in the main, by carrying passengers and

freight. Of the needs of the passenger service, which, as a rule, is of stable and uniform quantity, facilities are generally adequate and the organization and disposition of the service simple and direct in consequence. With freight, however, it is different. This is ever an unknown quantity. The traffic department by wise and far-reaching industry, and through the exercise of tact and a promise to protect patrons in the handling of their goods, aids in building up a stable and lucrative business—if, concurrently, the operating department is able to meet the needs of the service with necessary cars and motive power. If either of these is lacking, however, business is delayed and oftentimes lost in consequence. This has always been true but with increased competition, has become more pronounced; and it may be truly said that there is very little freight carried by railroads that is not competitive; that some other carrier—by land or water—is not striving to gain or divert; and will gain or divert if able to offer better facilities—greater surety in regard to the movement of the traffic, and greater celerity in handling it. There are few situations, few localities so isolated that shippers are compelled to submit patiently to delays in supplying their wants. In remote parts of the world there may be, indeed there are, localities where the carrier may, with perfect reasonableness, decline to send a car forward until there is a full load, whether it be hours or days in filling. In such cases there is the maximum profit to the carrier.

Shippers understand the situation and their business is built up to conform thereto. They acquiesce perforce in the rule that cars must be filled, and afterwards will not be hauled until there are full train-loads. Thus the maximum train mile tonnage is assured the carrier to the great gratification of owner and manager, and the no less great shame and mortification of managers of other roads where traffic must meet the instant wants of the patrons or be lost; and where, too, the result of such futile operations will, nevertheless, be compared with the more favored company—and very likely criticised unjustly because of the relatively poor showing.

Delay in moving freight represents loss to manufacturers and merchants, possibly injury to trade; and, so, quite likely its diversion to some other point of shipment. Thus, if there is lack of effective service carriers may, and do, lose business. It follows, therefore, that not only must a railway be supplied with necessary equipment, but those in charge must exercise requisite skill in making it available—must meet the emergencies of business that mean prosperity or the reverse. And it needs no demonstration to prove that a railroad company may have sufficient equipment to meet every reasonable requirement and yet be unable to do so through lax methods—want of system in handling its cars. It is not probable that there are any such cases of general or aggravated occurrence, (for railway companies are ever wise in selecting their officers) but a feature to be considered is that a

single failure to comprehend the situation and meet it skillfully, foretells loss as real and palpable as the loss of a company's cash or securities through neglect to safeguard the same.

It is undoubtedly true that with some companies the movement of traffic requires the handling of dead weight to a greater extent than with others. Fortunate the carrier that has a load in both directions for his cars; but in every case a considerable percentage of empty cars must be hauled back and forth to meet the requirements of business. And this is an engrossing feature that invites and receives constant attention. The official in charge follows each individual car with watchful solicitude and is quick to sidetrack it for a load at the earliest possible moment. And when the returns for the month are summed up, he notes with anxious brow the relation that the mileage of empty cars bears to the mileage of loaded cars. And if he has added somewhat to the latter, he is gratified—and very properly so—for it represents a distinct gain to his company in dollars and cents.

The handling and distribution of cars, even where the supply is abundant, is attended by many embarrassments. Thus, in the midst of busy preparations to meet known or expected wants, a washout or a great storm will interrupt traffic, and so utterly disarrange all the plans that have been made—put back the movement of cars for hours, perhaps weeks. Needless to say, when such mishaps occur the officers of a railroad are greatly annoyed and, oftentimes, un-

justly criticised. On the other hand, everything else being propitious, there may be a lack of motive power, either through some temporary derangement of the system or absolute lack of engines to do the business. Such contingencies are unavoidable and always will be. But of these vexations shippers know nothing. Or, if the matter is explained to them, give the carrier little indulgence. Nor is it desirable, perhaps, that they should. Sharp criticism—continual and urgent demand for accommodation—even though unreasonable, while annoying, nevertheless urges a management to the utmost that its own conscience may be acquitted of blame.

The multiplication of classes of cars to meet different kinds of traffic while it has greatly fostered and increased the freight traffic of railroads, has added immensely to the labor of apportioning cars to meet the varied wants that these diverse vehicles are intended to serve. Thus it is well known that refrigerator cars have, through their adaptability, created an enormous traffic that did not, nor could not exist without them; and so it is in a lesser degree, perhaps, with other patterns of cars. Naturally these cars, adapted to peculiar needs, are eagerly sought by shippers and oftentimes when a standard box or flat car could be made to answer. Nevertheless, the carrier desires to afford the customer exactly what he wants, and it results from the demand, and the necessarily restricted supply, that the demand is always in excess of the supply, and probably always will be. Naturally the car that

a railroad company can utilize for the greatest number of purposes is the more profitable to it. For the cost to carriers in meeting demands for special forms of cars is greater than in other cases, for the reason that they oftentimes have to be moved long distances empty in order to reach the place where required. It is true, that because of the peculiar nature of the freight, or the greater amount that may be thus handled, there will be an offset in revenue, in some degree, to this expense. But on the other hand it too frequently happens that these special cars have no load except in one direction. The character of these cars needs only to be known to emphasize this fact. Thus there is a car specially adapted, with permanent coops, for live poultry whereby fowl may be watered and fed and kept apart in transit, and so brought to market in good condition; so, too, of cars for horses, supplied with stalls and water facilities; refrigerator cars for fruit, dressed meats, vegetables, beer and similar perishable freight. Now, while it is true that traffic thus handled may pay better than ordinary car-lots, yet the handling of the cars entails unusual expense and oftentimes the supply is out of all proportion to the requirements of the service.*

As a rule an official known as The Car Service Agent has supervision over the freight cars of railroads. When cars are required at any par-

*Among the forms elsewhere herein, will be found a "List of Freight Cars," comprising the different classes that are in more or less general use by the railroads of America.

ticular point he is advised and makes his dispositions accordingly. Great progress has been made in this particular branch of the service in the way of systematizing the work so as to prevent cars lying idle, and to otherwise insure the economical and effective handling of equipment. Thus, if a car is needed at any particular station and there is a car available nearby, the Car Service Agent has knowledge of both facts and the company is thus saved the expense of, perhaps, moving a car from a more distant point. He not only supplies the cars needed for traffic, but knows what cars are most available for the purpose. His duties are, consequently, very important. But he is much dependent upon others, especially division superintendents, train dispatchers, train masters and station agents; and their hearty and intelligent co-operation is imperatively necessary to make his work all it should be. Moreover if allowed the latitude that the good of the service requires he will be free at all times to investigate those cases where cars are not loaded or unloaded promptly and, so, brought back into the service in the shortest time possible.

It is apparent that good judgment and a discerning mind must be displayed in moving empty cars to see that in doing so they do not pass each other in opposite directions; in other words, that a nearer and more available car is not overlooked. Every mile that an empty car is hauled represents a loss to the carrier. It not only fills up space in the train, which other-

wise might be occupied by paying traffic, but the cost of hauling is also to be remembered. In order to prevent this waste and secure prompt and economical distribution of the equipment, it is apparent that the Car Service Agent must be in immediate touch with the situation on every part of the road; and as far in advance of actual needs as possible. Thus, he is oftentimes able to anticipate the movement of commodities in advance of actual orders being given for cars; and so by judicious disposition have the equipment at the moment, near or at the place where it is needed. This implies that he is something more than a man of routine; that he is an organizer in fact. The situation requires that he should be a general, an executive, marshalling his army of cars singly or in numbers, where needed, and by the shortest and most economical route. To do this, it is manifest, he must know the location of every car, just what vehicles are available, those that will be available tomorrow, and the next day, and so on, so far as practicable. And similarly, where cars are needed, not only today but tomorrow and the day following, so that the equipment at disposal can be placed where needed with the least loss of time and power.

This is one phase of the supervision of cars. And on a great railway—and all railways are great—the territory to be served is widely extended and its needs great and varied. Surveying such an extended field during the rush of business and the conflict of interest as between

shippers and profitable and relatively non-profitable traffic, it is apparent that a company may make great profit by the judicious handling of its equipment; or, *vice versa*, suffer great losses through lack of good judgment and promptness. And this loss may be incurred without the carrier being conscious of the fact that it might have been avoided. That is to say, that according to the talent, industry and authority of the Car Service Agent, and the co-operation he receives, a company will gain the utmost fruits of its enterprise; or, if contrary conditions exist, will suffer losses impossible to estimate, of which, through ignorance, and evasions, the management of a property may never be conscious.

It is probable there are few, if any, officers of a railroad more harassed, more importuned, and upon whom more difficult burdens are sought to be laid every minute of a busy season, than the car service agent. The traffic department turns to him to meet conditions it esteems imperative. Through it, and other channels, patrons cry aloud, and angrily, for cars—not of a uniform class, but differing, to meet particular conditions. Thus the Car Service Agent will be notified today that five hundred cars will be required within a week at an elevator or group of elevators, to move grain. This will require a particular kind of car. From another point will come a demand for cattle cars; from another, cars to move furniture; from another, coal; from another, refrigerator cars to move dairy products; from another, timber; and so the orders will

multiply, until the needs exceed by hundreds or thousands, the cars available for use.

The Car Service Agent in the discharge of his duties in placing cars is, among other things, called upon continually by the agents of other companies for cars to meet inter-road traffic. Moreover, there will always be more or less cars belonging to other companies on his road to be watched and judiciously used, or sent home as expeditiously as possible. A company must pay mileage on these foreign cars, or a certain rate per diem; and so use is made of them when practicable; or, if they cannot be used, returned to the owner with all haste. Thus he strives, when a call is made for cars by local agents, to load those belonging to other companies with traffic going to, or in the direction of the road owning the same. Where such use is practicable the cost of hauling them empty is saved, and instead of a loss some advantage may be reaped. The Car Service Agent is, however, always exercised in regard to such cars; to see when they have been sent him on requisition or in due course of business and that they are loaded promptly and sent on their way; or, if they come to him with loads, that they are promptly unloaded and disposed of. It is undoubtedly true that no company desires that its cars should be away from its home line any longer than necessary. Neither mileage nor per diem adequately remunerates it for such diversion. Nor is it adequately compensated in those cases where a fine is imposed on the holding company for delaying the return of

a car. The fine is a burden to the delinquent and not a salve to the owner. Because of this Car Service Agents and others cognizant of the situation actively strive to keep their cars off other roads and to keep the cars of other companies moving—profitably if possible, but, in any event, moving.

In distributing equipment the Car Service Agent endeavors to place cars that can be used for current traffic when they reach their destination: in other words, to have a load for them both ways. His efforts in this and other directions are aided and simplified by the co-operative energy, tact and experience of his fellow operating officers and the station agents along the road. Much ever depends on the last named. If they are skillful, alert and diplomatic they will succeed in having cars loaded and unloaded in minimum time. If they lack these qualities the reverse will be the case, to the great loss of a company. For, in this connection, it is true here as in the case of other fines, that the demurrage charged by railroad companies for delays in loading or removing freight do not compensate it for the loss it suffers from its equipment being idle It is merely a palliative, a device intended to accelerate the movement of freight; to put pressure on the shipper to act with diligence, though nothing in any way unreasonable is asked of him. This feature of the service is and has been greatly facilitated by the creation of independent Car Service and Weighing Associations created by railroad companies acting in common; in other

words, consolidating their energies. It is the duty of the first named to see that a charge is made for demurrage when cars are not loaded or unloaded within a specified time. An equally important and necessary duty is that performed by the Weighing Association's agents, who are placed here and there throughout the jurisdiction of the Association, to weigh cars in transit and otherwise examine their contents to see that the carrier is not defrauded in regard to quantity or the nature of the freight. In reference to the Car Service and Weighing Associations and their usefulness, it may be said that their creation grew out, in part, of the strife of carriers to outbid competitors for business. Thus, to propitiate patrons carriers sometimes shut their eyes to delays in loading and removing freight, and even in regard to misrepresentations in reference to the quality or weight of freight. All this has been corrected through the Associations in question, as the managers and agents thereof represent a group of railroads, as a whole, and so having no private ax to grind, enforce tariff regulations frankly and impartially.

With the multiplication of cars (with every addition to the number thereof) greater and wiser supervision becomes necessary. Otherwise chaos will reign and the resources of a company be frittered away as the rain that falls from a roof. It may be said of the Car Service Agent, as it is of every railway official, that the greater his talent and alertness and resourcefulness, the greater the respect that will be paid him and

the more hearty the co-operation he will receive and, therefore, the more useful he will be.

His power, within the province of his office, should be commensurate with his responsibilities. His acts are founded upon accurate knowledge of the situation and the needs of the service, derived through returns and constant intercourse with those interested in the economical and expeditious movement of traffic. To divide the duty will be to weaken the service. Only the Car Service Agent commands the situation, not only by divisions, but for the road as a whole. He only is in touch with every condition and interest. And it rather adds to, than lessens, his usefulness that he acts, more often than otherwise, through division superintendents; officials, it is needless to say, as interested in effective service as he. But whoever the Superintendent designates to act for him in conjunction with the Car Service Agent—whether in his, the superintendent's office, or at the various freight districts, stations, or points of distribution—should be familiar with the geography of the road and the proper routing of both local and foreign cars. Concentration of authority and responsibility should be enforced everywhere; especially at stations. Here, either the yardmaster or agent should be supreme. Thus clashing will be avoided and if the service is ineffective it will not arise from confusion attendant upon the exercise of divided responsibility, but may be definitely located and action taken accordingly. And in reference to station officials

it is through them and not through conductors, that the movement of cars is ordered.

No empty car, it may be said, should be moved on a road except under orders from the Car Service Agent; and that there may be no confusion or frittering away of resources, all requisitions for foreign cars should be made by him. And of the movement of foreign cars on the line (after being unloaded) that, also, should be under his supervision, that their direction may be homeward and, meanwhile, that use may be made of them when practicable.

While it is true that the Car Service Agent's duties are restricted, in the main, to providing vehicles to meet the wants of shippers, and other fundamental things accessory thereto, his suggestions and surveillance should be invited in all things attending delay of cars from whatever cause. And he should be encouraged to watch the daily mileage of cars on his road with the object of ascertaining whether the average is favorable or not. And in this respect he will be aided in forming judgment by such comparisons as he may be able to make with the mileage of cars on other roads. These things harmonize naturally with the duties of the Car Service Agent, whose particular office it is to see that cars are effectively used; and, incidentally, that the greatest possible tonnage is moved therein without unnecessary delays. For the number of empty cars at his disposal will always depend upon whether cars are fully loaded and are handled with celerity. Every moment of delay

after a car is loaded puts off, by so much, its availability for handling new business.

All those through whom the Car Service Agent acts should be amenable to discipline by him. For he cannot otherwise enforce effective measures in the event of incompetency or neglect on the part of those upon whom the service is dependent for the efficient handling of cars. And so, if lacking authority, he will quickly become a mere creature of routine, a clerk, without voice or potency.

It is possible, nay probable, that on every road there will be more or less traffic corresponding in its regularity and scope to the passenger service. And when this is so the equipment intended to serve such business, will naturally and without special orders seek the point where it is needed. Thus it will be, perhaps, in regard to the return of stock cars to the places where they are loaded; and, similarly too, in regard to the movement of coal cars to coal centers, and so on. Moreover, as there are exceptions to every rule, so there will be emergencies, as in the case of wrecks and the chance accumulation of cars in congested districts, where the superintendent, or a lesser agent, must act quickly and independently of the Car Service Agent—but never without instantly advising him of such action.

In the discharge of his arduous duties the Car Service Agent will find it necessary to keep a careful record of the cars of his company in the possession of other lines. Only thus can he exercise a necessary check on the requisitions of

such companies for cars, or prevent unnecessary delay or improper use of his company's equipment. In this way he not only conserves the interests of his own company but, indirectly, of the other as well.

On those lines where compensation for the use of cars is based on mileage, there is no incentive to hasten the return of a car to its owner. It may be used furtively in local business, or may be sidetracked and left indefinitely if it is inconvenient to handle it. In any event it is not a subject of worry or expense to the holding company. On the other hand, what is termed the Per Diem system requires the payment of a certain sum per day for every day that a car of another company is held—the rate being greatly increased in the shape of a fine, after a stated length of time. The effect of this is, of course, to hasten the return of foreign cars, and in so far as this is the case it serves to lighten the harassing burdens of the Car Service Agent.

The handling of freight, like everything that attends living and growing industries, is one of transition. The things that were unheard of yesterday become common today. Thus, at one period, no special thought was given to the movement of freight, except particular classes, like live stock. It was put into a car and sent forward, and under the general rules of the company would, with other cars, find its way, in due course, to its destination. And this is true today with much of the freight that is moved. But there has grown up to meet the needs of business—

accentuated by competitive effort—what is termed "Time Freight," a species of traffic—not necessarily perishable—but of special significance in the economy of the service. The movement of such freight is as rigidly fixed (and oftentimes as rapid) as the movement of passengers. Within the time limit fixed the shipper and receiver, know within an hour when the freight will reach its destination. It thus corresponds to the express service in this country and the parcel traffic abroad. And of such importance is it in the operation of carriers and the needs of merchants and manufacturers that whole warehouses or sections thereof are set apart for their special use. Thus, a car loaded by a merchant, or in common, in Philadelphia in the afternoon will be unloaded in Pittsburg the succeeding morning; and this, with as much certainty as a passenger has that he will be transported a given distance within a certain number of hours. Time freight is watched throughout its journey by the Car Service Agent and others whose duty it is to see that no delay occurs, or if delay does occur, that it is instantly reported that action may be taken, as in other things of urgency and importance.

While the affairs of railroads are generally similar, there are always peculiar features to be considered in connection with each. These may relate to the geography of the road, its traffic, its equipment, or the peculiar characteristics of its officers. And of the last, the prosperity of a company it may be truly said, is as much affected as by any of the other three things mentioned.

It consequently falls out because of these diversities, and for other reasons not necessary to particularize, that the methods in vogue on different roads are not uniform. And of methods it may be said, they are like muskets; they must conform to the strength of the arm that holds them. The system that is admirable in the hands of one man, is ineffective in those of another. All are effective if effectively handled. Forms, therefore, are not of supreme importance. Nevertheless it cannot but be true that those which accomplish the most comprehensive ends with the least labor and greatest surety, are the most valuable. And it is along such lines, that the various forms in use by Car Service Agents have grown up. These forms, so far as it is thought necessary to include them, will be found elsewhere herein. They are the mediums through which the Car Service Agent, and others working along similar lines, derive their information in regard to the condition of affairs. From these returns the Car Service Agent knows from the reports of the conductors what cars are in transit and on what trains; and from the returns of agents, he is advised of the cars at each station, whether loaded or empty, the condition of the same—if in bad order,—what cars are needed to meet the demands of shippers, and the classes of cars needed. He has in fact every species of information necessary to a perfect comprehension of the company's needs and resources, both at home and on other roads. These returns will be found exceedingly interesting

and instructive to all wishing to acquire insight or practical knowledge of the business of handling the freight cars of railroads. I am indebted for these forms to those immediately connected with the car service of railways, but more particularly and especially to Mr. William P. Marsh, a veteran car service agent connected with one of the great railroads of the country.

Rules Governing the Interchange and Joint Use of Cars by Railroad Companies.

In order that there might be uniformity of action by railroads, in the use of the cars of other companies, and for other good reasons, rules and regulations governing such use have been promulgated by the railway companies interested. These are enforced in good faith on the lines subscribing to the agreement.

(Note.—I do not refer here to the rules and regulations of the Master Car Builders' Association, but to others relating to the common use of cars by carriers.)

While these rules are changed in minor particulars from time to time, to meet new conditions they are, in general effect, as follows:

1st. Foreign Cars (that is the cars of other companies) are required to be promptly returned to the home roads—and by "Home Road" is meant the road which owns the car, or upon which the home of the private car is located.

Foreign cars may be properly used as follows:

(a) Loaded to points on or reached by using the home road.

(b) Loaded to intermediate points in the direction of the junctions at which they were received.

(c) If returned empty, they should be moved over the routes by which they were received.

Foreign cars may be sent empty in the direction opposite to

the junctions at which they were received for loads to points on or reached by using the home roads, but not otherwise.

Foreign cars must not be sent empty to connecting roads without the permission of the owners, except for switching service. Loaded or empty cars received for switching service must be confined to switching limits, and returned to the home or the delivering road.

When empty foreign cars are delivered by one line to a connection for return loading via the road making the delivery, they must be so loaded and returned.

If loaded foreign cars on their return movements are reconsigned and such re consignments would cause diversions of the cars, the lading must be transferred under the rules governing transfers at points of diversion, if this can be done without injury to it, and the cars must be returned to the owners or to the roads from which they were received. In case the lading is of such a character that it cannot be transferred without injury, the cars may be run through as re-consigned, but the facts of the case must be promptly reported to the owners of the cars.

Cars shall be considered as having been delivered to a connecting railroad when placed upon the track agreed upon and designated as the interchange track for such deliveries, accompanied or preceded by proper data for forwarding and accepted by the car inspector of the receiving road.

Unless otherwise arranged between the roads concerned, the receiving road shall be responsible for the car's contents and per diem after receipt of the proper data for forwarding and until they have been accepted by its inspector or returned to the delivering road.

New freight cars shall be stenciled when built with actual light weight, date of weighing, and capacity. Steel cars shall be re-weighed and re stenciled within the first year thereafter, and wooden cars at the end of the first and second years.

All cars which have received general repairs shall be weighed and stenciled, with the actual weight, immediately before being put back into service.

Any car without stenciling shall be immediately weighed and stenciled. New weights of foreign cars shall be reported to car owners.

The maximum excess allowed over the marked capacity of freight cars shall not exceed 10 per cent of such marked capacity.

The placing of advertisements or placards of any kind by shippers upon freight cars is prohibited.

CHAPTER II.

List of Car Service Agents' Forms.

In embodying the accompanying forms it is not sought to convey the idea that these particular forms are in use on every road, or that they are better than others. The same diversity exists in this particular field of industry that does in every other. Each company uses the forms that, according to its lights, are best adapted to its wants. And many of them have been aided in this by careful inquiry into the practices and forms used by other companies. The most that can be said of the accompanying forms is that they have been found to meet the requirements of particular roads and so have, therefore, a practical value. Their greatest use, here, to the student, is in the way of illustration.

The explanation of the forms has been compiled with the same view—to aid those who are not practically familiar with the work of supervising the movement of cars. The forms used by the car service agent, like all forms of a like nature, are his means of focusing operations—aids in supervising and regulating his business.

C. S. 1. THE LOCAL FREIGHT CAR RECORD.
C. S. 2. FOREIGN FREIGHT CAR RECORD.
C. S. 3. CONDUCTOR'S REPORT OF FREIGHT TRAIN.

C. S. 4. REPORT OF INTERCHANGE OF FREIGHT CARS WITH OTHER LINES.
C. S. 5. POSTAL CARD NOTICE TO OWNER OF CAR OF ITS CARS DELIVERED BY A FOREIGN LINE TO ANOTHER FOREIGN COMPANY.
C. S. 6. TRACER FOR DELAYED FREIGHT CARS.
C. S. 7. DAILY REPORT OF FREIGHT CARS ON HAND.
C. S. 8. AGENT'S ORDER FOR FREIGHT CARS.
C. S. 9. FOREIGN CAR ORDER.
C. S. 10. TELEGRAPH NOTICE TO AGENTS OF FREIGHT CARS BILLED TO THEM.
C. S. 11. TELEGRAPH ORDER DIRECTING MOVEMENT OF FREIGHT CARS.
C. S. 12. NOTICE OF ERRORS AND OMISSIONS.
C. S. 13. TELEGRAPH EMPTY CAR REPORT.
C. S. 14. SUPERINTENDENT'S TELEGRAPH REPORT OF FOREIGN FREIGHT CARS ON HAND FOR WHICH THERE IS NO USE.
C. S. 15. SUPERINTENDENT'S DAILY TELEGRAPH REPORT OF FREIGHT CARS WANTED AND AVAILABLE.
C. S. 16. RECORD OF ORDERS RECEIVED BY CAR SERVICE AGENT FOR FREIGHT CARS.
C. S. 17. AGENT'S TELEGRAPH REPORT OF TIME FREIGHT FORWARDED.
C. S. 18. AGENT'S TELEGRAPH REPORT OF TIME FREIGHT ENROUTE.
C. S. 19. CONDUCTOR'S TELEGRAPH REPORT OF TIME FREIGHT LEFT (DELAYED) ENROUTE.
C. S. 20. AGENT'S TELEGRAPH REPORT OF DELAYED TIME FREIGHT FORWARDED.
C. S. 21. LIST OF FREIGHT CARS.

CHAPTER III.

Forms Used by Car Service Agent.

C. S. 1.

The Local Freight Car Record.

This blank is used by a railroad company for the purpose of recording the movements of its freight cars on its own (home) line and the movements of its freight cars on other (foreign) lines as well. Each page of the record has four sections like the form herewith. The blank is thus ruled to provide a record of fifty cars to a page. On each side of the page are printed the two ending figures of car numbers, the full numbers of the cars—as illustrated—being written in at top of each page. In the first column to the left is entered the last record in preceding book. At the top and bottom of the page are printed the dates of month. This arrangement enables the records to be entered in the proper date column without writing in the dates. In explanation of this form, a practical illustration is given: thus Car No. 7102 was at station No. 43 on the 15th. The book is arranged to run four months. At the expiration of this period a transfer into a new record is necessary. This form of local record book is in use by many railroad companies with perhaps some slight variations. The car numbers are entered herein daily from conductors' reports; agents' reports of cars interchanged with other roads; and reports from foreign roads of cars delivered to other lines. Two kinds of ink are generally used; black to designate loaded cars; red to designate empty cars. Cars on foreign lines may be entered in black ink; some roads use purple ink to record cars that are away from home.

LOCAL FREIGHT CAR RECORD. C. S. 1.

(¼ of the page.)

Movements of Cars from _____ ___19___ to _____ 19___

(Illustration: Cars Nos. 7100 to 7198.)

Last Record brought forward	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
00																																00
02															43																	02
04																																04
06																																06
08																																08
10																																10
12																																12
14																																14
16																																16
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32																																32
34																																34
36																																36
38																																38
40																																40
42																																42
44																																44
46																																46
48																																48
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	

C. S. 2.

Foreign Freight Car Record.

This blank is used by a company to record the movements of foreign freight cars in its possession.

Across the top and bottom and center of the page are printed dates of month to facilitate entries. To the extreme left are columns provided for car numbers, a column to enter from what railroad received, at what station received, date of receipt, location of car (if transferred from preceding month's record) and date of said location. Thus, as an illustration, car 4073 was received from the Illinois Central R. R. at station No. 4 on April 23rd; it was at station No. 86 April 30th, according to the previous month's record, and at station No. 350 the 10th of the current month.

This record is intended to run one month. At the top of the page is entered the name of the road owning the cars, and the month and year for which the record is used. To the side and bottom margins may be affixed heavy paper tabs on which the name of the owners of the cars may be entered. By this means of indexing the owner can be located without loss of time.

Two colors of ink are used; black for entering the movements of loaded cars, red for empty cars. This form of foreign record is used more or less generally. The system of indexing suggested is a particular feature that it is thought will appeal to car service officers.

C. S. 2.

FOREIGN FREIGHT CAR RECORD.

Record of Movements of _____ R. R. Freight Cars During Month of _____ 19___

	Cars Received							Last Record Brought Forw.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Car No's				Rec. from R. R.	At Sta.	DATE	At Sta.	DATE																															
	4	9	7	3	I.C.	4	4 23	98	1/30										350																				
										1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

C. S. 3.

Conductor's Report of Freight Train.

This form is used by freight train conductors in rendering a return of freight cars hauled in their trains. It is the basis—source of information—of car records, forms 1 and 2. It is consequently of the greatest importance. Its essential features, aside from certain important details relative to the trains, are whether cars are loaded or empty, car initials, car numbers, point billed from, point billed to, where taken into trains, and where left. In addition to this the weight of and contents are required for purpose of tonnage statistics.

To facilitate the uses of the conductor's train reports by different departments, it can be made in duplicate by the insertion of a carbon sheet.

CONDUCTOR'S REPORT OF FREIGHT TRAIN.

C. S. 3.

FREIGHT CONDUCTOR'S TRIP REPORT. *Train No.*_____ *Date*_____ *19*____

*Ordered to leave at*_____ *M. Left*_____ *at*_____ *M. Arrived at*_____ *Station at*_____ *M.*

*Conductor*_____ *Brakeman*_____

	CLAIMED.		ALLOWED	
	Through	Way-Freight	Through	Way-Freight
Scheduled Mileage, - - - -				
Overtime, - - - - - - - -				
Delayed Time, - - - - - -				
Switching at Terminals, - -				
Total Mileage for Day's Work,				

*Miles run*_____

REMARKS.

The numbers and initials of cars must be taken from the cars and not from way-bills.

	INITIALS	CAR NUMBERS		OFFICE CHECK COLUMN	BILLED FROM	BILLED TO	WHERE TAKEN	WHERE LEFT	CONTENTS	CAR MILE-AGE	Weight of car & contents in tons	This column is to be left blank.	
		Loaded	Empty										TON MILES.
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													

C. S. 4.

Report of Interchange of Freight Cars with Other Lines.

This form of report is to notify the car service official of the interchange of freight cars with connecting lines. It is of great importance. It gives particulars of cars delivered to the connecting lines and a similar blank shows cars received from connecting lines. The form explains its particular details.

Care must be exercised by agents in writing up this report, for if a car should be omitted or incorrectly given it would not harmonize with the conductor's report of cars moved, thus creating confusion and necessitating letters of inquiry upon the part of the Car Service Agent.

C. S. 4.

REPORT OF INTERCHANGE OF FREIGHT CARS WITH OTHER LINES.

_____ Station, No. _____

DAILY INTERCHANGE REPORT OF CARS DELIVERED TO _____ R. _____

X Loaded.
— Empty. From _____ M., to _____ M., _____ 19__

INITIALS 1	Kind of Cars. 2	NUMBER 3	X 4	Check	POINT OF SHIPMENT 5	FINAL DESTINATION 6	CONTENTS 7	Hour Delivered 8
				1				
				2				
				3				
				4				
				5				
				6				
				7				
				8				
				9				
				10				
				11				
				12				
				13				
				14				
				15				
				16				
				17				
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				32				
				33				
				34				
				35				
				36				
				37				
				38				
				39				
				40				
				41				
				42				
				43				
				44				
				45				
				46				
				47				
				48				
				49				
				50				

I certify that these cars were received as above.

_____ Agent _____ R. _____

_____ Agent.

C. S. S.

POSTAL CARD NOTICE TO OWNER OF CAR OF ITS CARS DELIVERED BY A FOREIGN LINE TO ANOTHER FOREIGN COMPANY.

JUNCTION REPORT OF CARS DELIVERED TO OUR CONNECTIONS.

On.....19..... (Printed Signature)

(Title of Officer)

X Loaded. —Empty. (Address)

CAR.		X —	DELIVERED TO (Full Initials)
Full Initials.	Number.		

NOTE.—This form is used by foreign roads to notify owners of the delivery of their cars to still other lines. It is the source of information from which the record is compiled by the owner of whereabouts of the car on foreign lines.

C. S. 6.

TRACER FOR DELAYED FREIGHT CARS.

OFFICE CAR SERVICE AGENT.

_____ _____ 19____

_____

Agent, _____

Dear Sir:

According to my record _____ _____

car No. _____ _____

_____

arrived at your station on _____

since which time it has not moved.

Please note hereon disposition made of this car and return this letter by first train.

_____

Car Service Agent.

To the Car Service Agent,

Dear Sir:

Below find disposition of equipment specified above.

_____

_____

_____

_____

(*If car has been forwarded, give date, train and destination.*)

_____

Agent.

NOTE.—The above is a printed form of letter of inquiry which is sent to station agents to secure disposition of freight cars the movement of which seems to be unduly detained. This blank is also used to secure information regarding disposition of cars that have been delivered to connecting lines and not reported; also of cars moved by conductors and not reported. Through its use car service officer traces and secures movement of delayed cars.

Form C. S. 7.

Daily Report of Freight Cars on Hand.

This report must include all freight cars at the station at the time made, or on tracks connected therewith, over which the agent has jurisdiction. It must be made at 3 o'clock in the afternoon of each day (Sundays excepted) whether cars are loaded or empty, the numbers being placed under the proper heading. The report must be made in duplicate, one copy being sent to the Division Superintendent and one to the Car Service Agent. Full reasons must be given for any detention of cars. Through this report those interested are advised of the location of every car on a road, (at stations and on sidings) and so are enabled to take measures in regard to the disposition of same. Full initials of the road owning the car should be given in the first column. In the column headed "Description of Car" the following abbreviations will be used:

Long Box (34 ft. long or over)...L. B.	Special Feed and Water.F. & W.
Short Box (under 34 ft.)..S. B.	Special Feed.....Feed
Hay Cars.....H. C.	Double Deck..... .....D. D.
Furniture Cars (show length)..F. C.	Short Single Deck.....S. S. D.
Refrigerator..... .....R. F.	Long Flat.....L. F.
Common Coal Long ...C. C. L.	Short Flat (under 34 ft.)..S. F.
Common Coal Short ...C. C. S.	Raised Center Flat .. R. C. F.
Drop End Coal Cars..D. E. C.	Work Train Flats....W. T. F.
Low Side Gondola....L. S. G.	Burk and Chain Flats..B. C. F.

C. S. 7.

DAILY REPORT OF FREIGHT CARS ON HAND.

At _____ Station, 8 o'clock P. M. of _____ 19__

_____ Agent.

	Whose Car.	No. of Loaded Car.	No. of Empty Car.	Description of Car.	Date of Way-Bill.	Date Arrived.	Date Placed for Unloading.	NO. OF DAYS DETAINED. Unloading.	Empty.	Loading.	CONTENTS.	CONSIGNEE.	Is Car Service Being Collected?	REASON OF DELAY.
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														

C. S. 8.

AGENT'S ORDER FOR FREIGHT CARS.

RECEIVED FROM	TIME RECEIVED	SENT BY	RECEIVED BY

From ..... Station ..... 19..

To CAR SERVICE AGENT .....

A. Order No. ..... Time filed ..... M.

B. Number of cars wanted .....

C. Initials .....

D. Class of cars wanted .....

E. Size of cars wanted .....

F. Where wanted .....

G. To be loaded with .....

H. Destination of load .....

I. Routing in full including point car leaves our rails .....

J. Latest date cars can be used .....

K. Remarks: .....

NOTE.—This car order blank is used by agents to place orders for freight cars for a specific purpose and is so arranged as to enable them to specify the kind of cars needed; destination of load; kind of freight to be loaded; the routing, if it leaves the rails of home line; date on which the car must be ready for loading, and so on. There is also a space provided for any special instructions that the agent may wish to give in placing the order. If the order is sent by telegraph only the letters are indicated therein: as, say, "B" would be understood to mean "Number of cars wanted," etc.

The blank spaces at top are filled up by the telegraph operator.

FOREIGN CAR ORDER. C. S. 9.

OFFICE OF CAR SERVICE AGENT.

_____ 19___

_____

_____

Order No. _____

Deliver us _____

Carded _____

_____

_____

To load with _____

Destination _____

Route _____

_____

_____
Car Service Agent.

NOTE.—This blank is used by the car service agent as a requisition on other companies for freight cars to load via their lines; that is if he is unable to pick up the foreign equipment he requires, on his own road.

Car Service Telegraphic Code.

Codes by which information in regard to the movement of freight cars can be sent by telegraph with the least delay and labor are in general use to meet the requirement of the car service bureaus. The following is one method. The principal stations, junctions and division stations are designated by one or more letters. To each station thus lettered is assigned a series of numbers to be used in numbering the way-bills for cars which are to be reported to the car service agent enroute. Each code station uses its numbers consecutively, commencing with the lowest. When the highest number has been reached, the agent commences anew with the lowest number, and so on. Thus to Chicago might be assigned the prefix "CH."; St. Louis, "S.L."; Memphis, "M", with number series 1 to 500 each inclusive. Cars originating at Chicago would be known as C. H. 1, C. H. 2, C. H. 3, etc., and so reported by the agent at Chicago to the Car Service Agent. The agent's report is filed as a permanent record and to it is added the movement of the cars as they are reported by code stations enroute. Cars way-billed with a code letter and number are reported to the Car Service Agent by telegraph under their respective code letter and number only, no reference being made to the car initials or numbers. The code letter indicates the forwarding station and the number of the car. Thus, the Car Service Agent can quickly refer to the record and enter thereon the progress of the car from station to station, and, if need be, take steps to remedy any delay that occurs. The system effects a great saving in telegraph work and lessens the labor of the Car Service Agent.

TELEGRAPH NOTICE TO AGENTS OF FREIGHT CARS BILLED TO THEM.

_____

_____ 19____

To_____

_____

We have billed to (A)_____ on

order number (B)_____ the following cars_____

_____

_____

_____

_____

Car Service Agent.

NOTE.—The above blank is used by the car service agent in notifying agents of freight cars billed to them to apply on their orders. They are thus kept advised as to progress made in filling their requisitions and advised on what orders the cars are to be applied when received. The car service agent in telegraphing uses only the letter "A," which the recipient understands to read "We have billed to you"; similarly, "B" means "On order number."

TELEGRAPH ORDER DIRECTING MOVEMENT OF FREIGHT CARS.

OFFICE OF THE CAR SERVICE AGENT.

_____ _____ 19____

_____

_____

ORDER No._____

BILL TO_____ _____

_____

_____

NOTE.—The above is a form used by the car service agent in telegraphing orders for movement of freight cars.

C. S. 12.

NOTICE OF ERRORS AND OMISSIONS.

OFFICE CAR SERVICE AGENT.

_____ 19____

_____

_____

DEAR SIR:

On your Car Report Form_____

Date_____ 19____

your report_____

_____

_____

It should be_____

_____

_____

You will please make correction as indicated above and return this with your reply without delay.

Yours respectfully,

_____

Car Service Agent.

NOTE.—The above is form of advice used by the car service agent to notify conductors and agents of errors in their reports. By this means conductors and agents correct errors in their respective records, so that if information is asked of them subsequently they will be able to answer correctly.

C. S. 13.

Telegraph Empty Car Report.

This is a form of agents' daily telegraph car report used on some lines. The blank is arranged to last one month. It serves as a permanent record and should be carefully preserved and filed for future reference. It is similarly used by the Chief Dispatcher in recording the report; from it he compiles the condensed report to the Car Service Agent for the division. The information in regard to each class of cars is grouped together and to each group and column is assigned a letter which is used to facilitate transmission. Thus, in reporting a shortage of ten empty furniture cars, all that need be sent is "V. A-V-10," and so on.

Four items are shown under the several classes of equipment, namely: Shortage of empty cars; Surplus of empty cars; Empty cars wanted, and cars actually unloading. With this information the division official can make intelligent provision for the needs of each station on his division and at the same time the Car Service Agent can relieve a shortage on one division from a surplus that may prevail upon another division.

TELEGRAPH EMPTY CAR REPORT.

C. S. 13.

From Station_____ For month of_____ 19___

"V" SHORTAGE OF EMPTY CARS.—Make an intelligent estimate of cars required in excess of the cars available within the next twenty-four hours, either for local loading or for delivery to connecting lines, by taking into account the empties on hand, loaded cars which are likely to become available by unloading, the probable receipts of empties from connecting lines within the next twenty-four hours; also, the general condition of business, and report as shortage only such cars as it is necessary to forward from other points

"W" SURPLUS EMPTY CARS.—Include such empty cars as are on hand at the time of the report which can be spared without interfering with business during the next twenty-four hours. Do not include slip billed cars awaiting transit. Give initials of foreign cars and home routes. Junction stations will not include switched cars to be returned to connecting lines, nor foreign cars awaiting delivery to home lines which, therefore, are not available for loading.

"X" EMPTY CARS ON HAND WANTED.—Do not include cars in process of loading, nor empty cars which will not be required within twenty-four hours.

"Y" CARS ACTUALLY UNLOADING.—Large stations will only report the number for each column, other stations will report in detail, giving initials of foreign cars. Junction stations will not include switched cars to be returned to connecting lines when empty, nor other foreign cars which will be delivered to home or connecting lines when empty, and which, therefore, will not be available for loading via this road.

DATE	FURNITURE A				BOX 36 FT. AND OVER C				BOX UNDER 36 FT. D				PALACE STOCK G				SINGLE DECK STOCK H				DBL DECK STOCK J				FLAT K				GONDOLA M				REFRIGRTR N				MISCEL. Tank,Poul.Etc. Q				TIME SENT
	Shortage V	Surplus Empty Cars W	On hand Wanted X	Actually Unloading Y	Shortage V	Surplus Empty Cars W	On hand Wanted X	Actually Unloading Y	Shortage V	Surplus Empty Cars W	On hand Wanted X	Actually Unloading Y	Shortage V	Surplus Empty Cars W	On hand Wanted X	Actually Unloading Y	Shortage V	Surplus Empty Cars W	On hand Wanted X	Actually Unloading Y	Shortage V	Surplus Empty Cars W	On hand Wanted X	Actually Unloading Y	Shortage V	Surplus Empty Cars W	On hand Wanted X	Actually Unloading Y	Shortage V	Surplus Empty Cars W	On hand Wanted X	Actually Unloading Y	Shortage V	Surplus Empty Cars W	On hand Wanted X	Actually Unloading Y	Shortage V	Surplus Empty Cars W	On hand Wanted X	Actually Unloading Y	

INSTRUCTIONS.—This report must be made in detail each day and transmitted by telegraph to the Chief Dispatcher at the designated time. At the end of each month it must be filed so that it can be produced at any time.

O S. M.

SUPERINTENDENT'S TELEGRAPH REPORT OF FOREIGN FREIGHT CARS ON HAND FOR WHICH THERE IS NO USE.

This is a telegraph form for reporting foreign freight cars remaining on hand for which no home load is obtainable.

This report gives the initials and numbers of all foreign cars. This information is telegraphed to division headquarters daily by every agent having such cars on hand and is there consolidated in one report. This last is telegraphed to the car service officer, who immediately examines the same and indicates disposition to be made of cars thus reported. This he telegraphs to the division headquarters. In sending the report only the letters at the head of the columns are used. Thus "A" indicates the location of the car as "A" Toledo, "B" initials, etc. By means of this report the car service officer is each day advised of all surplus foreign cars on the line, and is thus enabled to move them to points where home loading can be secured; or, in event there is no load, to give directions as to what line and via what junction they shall be sent home empty. An important purpose of this report is to enable the car service agent to hasten the return of foreign equipment for which there is no use.

C. S. 14.

SUPERINTENDENT'S TELEGRAPH REPORT OF FOREIGN FREIGHT CARS ON HAND FOR WHICH THERE IS NO USE.

To Car Service Agent: _____ 19____

Foreign Freight Cars on hand Empty at 6 P. M.

	LOCATION A	INITIALS B	CAR NO.	Kind C	Len. Feet D	ORIGINAL RECEIPT H		Date	DISPOSITION J
						Road	Point		
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									

This report should also include cars stored or held for prospective business.
One car number only should be inserted on each line.
When necessary to use second sheet commence it (in first column) with No. 28.
Columns H and J should not be filled up.

Signature _____

C. S. 15.

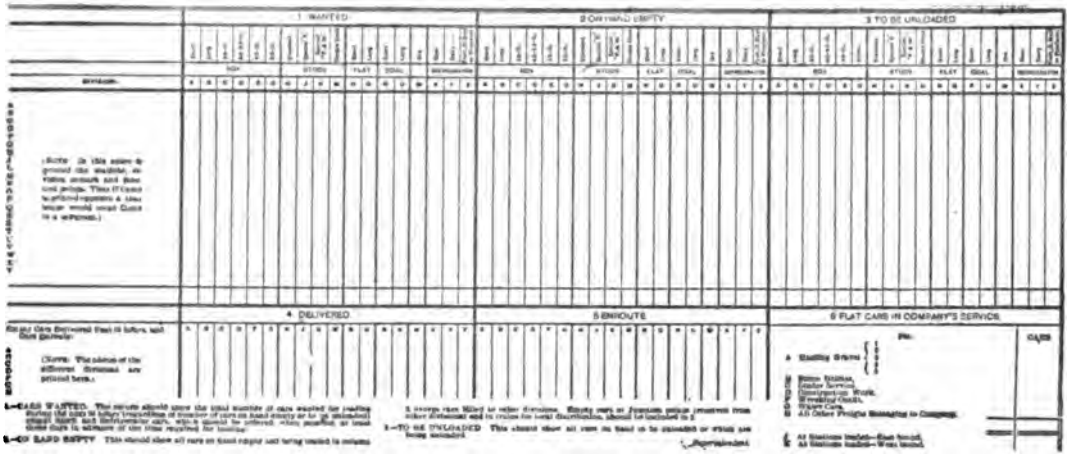
Superintendent's Daily Telegraph Report of Freight Cars Wanted and Available.

This form of telegraph report is made daily to the car service agent at 7:30 A. M. by division superintendents. It shows what cars are needed and the equipment on the division that can be applied thereon. The blank is so arranged that all necessary information can be transmitted by wire with the minimum telegraph work. The different lengths of box cars, different classes of stock cars and different lengths of flat and coal cars being each represented by a single letter. The blank is subdivided so that spaces are provided for cars wanted; empty cars on hand; cars to be unloaded; cars delivered connecting divisions; cars enroute; and cars in special service. The different subdivisions are represented by a numeral. Thus, if the superintendent wished to notify the car service agent that ten long box cars were wanted at station "G," he would telegraph "1-B-10-G." Or, if he wished to notify the car service agent that there were thirty-three long empty box cars on hand at station "G," he would telegraph "2-B 33 G;" and so on through the six subdivisions. All the receiving operator has to do in the first instance is to enter upon the blank the figure "10" in subdivision "1" in column "B" opposite station "G." And in the case of long box cars on hand empty at station "G," he would enter "33" in subdivision "2" column "B" opposite station "G."

This report indicates the car situation on the various divisions of a road with the minimum of telegraph work, and upon it the car distributor greatly relies in moving cars between divisions, etc.

SUPERINTENDENT'S DAILY TELEGRAPH CAR REPORT OF FREIGHT CARS WANTED AND AVAILABLE.

To Car Service Agent. 7:30 A. M. _____ 19___



C. S. 16

Record of Orders Received by Car Service Agent for Freight Cars.

This form is to record orders received for freight cars. It is bound in book form. The form shows: First, date of filing the order; order numbers; where cars are wanted; number of cars required; kind of cars—whether box, stock, furniture, refrigerator, and so on; length of cars, carrying capacity, destination, routing (if destined to point beyond the home line); date cars must be at station for loading and (if ordered from connecting line) a column for name of road with whom the order is placed. Space is also provided for recording numbers and initials of cars furnished on each order.

Orders are numbered consecutively and all correspondence referring to each order is kept intact and filed for reference.

By means of this record the car service agent is kept advised of cars wanted.

The record is one of value and is referred to constantly. Thus in looking up the diversion of foreign equipment (furnished on orders) it is possible to locate the same at once by this record.

C. S. 16

RECORD OF ORDERS RECEIVED BY CAR SERVICE AGENT FOR FREIGHT CARS.

DATE		ORDER NO.		WHERE WANTED	No. of Cars Wanted	DESCRIPTION			DESTINATION	ROUTING	Date Wanted	Ordered From	CARS FURNISHED
Month	Day	Car Ser. Agts No.	Train Disp. No.			Class	Length	Capacity					

AGENT'S TELEGRAPH REPORT OF TIME FREIGHT FORWARDED. C. S. 17.

15 REPORT.

Station_____ Date_____19___

The following cars of TIME FREIGHT left this station on Train No._____at_____M.:

Code Letter and Number	CAR		CONTENTS	DESTINATION	If final destination is to point beyond ourline, give									Delivery to Connecting Line			
	Initials	No.			Junction point where it leaves ourline	Routing beyond	Station	Time Left	Train	Date	Station	Time Left	Train	Date	Time Arr.	Time Del.	Date	Name of Line
A	B	C	D	F	G	H												

(a) ___ Agent.

(b) _____ Yardmaster.

This should be sent to car service agent by telegraph immediately after departure of cars.

NOTE.—This form is used by agents to notify the car service agent of the forwarding of "Time Freight." The various columns provide for code letter and number assigned to the station, car initials, number, etc.

Thus "A" is the code letter signifying the station, "B" initials of the car, "C" number of car, and so on. In this respect it is the only report in which the initials, number, contents and destination of cars are given; in other reports of the movements of cars (after forwarding) they are designated entirely by code letter and code number.

C. S. 18.

AGENT'S TELEGRAPH REPORT OF TIME FREIGHT EN-ROUTE.

Station_____ Date_____ 19___

The following cars, Way-billed TIME FREIGHT, passed this Station (or were delivered Connecting Line) on date and time given below:

CODE LETTER AND NUMBERS			TIME ARRIVED	TIME LEFT or Delivered Connecting Line	TRAIN NUMBER
Code Letter	From Lowest Number	To Highest Number			
B	C	D	F	G	H
			M	M	
			M	M	
			M	M	
			M	M	
			M	M	
			M	M	
			M	M	
			M	M	
			M	M	
			M	M	

(A)_____ Yardmaster.

(B)_____ Agent.

NOTE.—This report is sent by telegraph to the car service agent, immediately after arrival and departure of cars. The form is used for reporting by telegraph the passing of time freight by agents at freight terminals. The code letter; code number; arriving time; time of departure and number of train is all that is required.

C. S. 19.

CONDUCTOR'S TELEGRAPH REPORT OF TIME FREIGHT LEFT (DELAYED) ENROUTE.

The following cars, way-billed TIME FREIGHT, were set out (left) at

Station_____

Date_____ 19___

CODE LETTER AND NUMBERS			By Train No.	REASON (Give exact cause for leaving car)
Code Letter	From Lowest No	To Highest No.		
B	C	D	F	G

_____ Conductor.

Train No._____

NOTE.—This report is made promptly and handed to the operator at the nearest telegraph station, who should send it at once to the car service agent, a copy being sent to the chief train dispatcher of the district on which cars were left. It is used by conductors to report to the car service agent time freight left short of destination. It is telegraphed in the condensed form shown, nothing being transmitted except code letter and code number, number of train setting out car and reason therefor.

C. S. 20

AGENT'S TELEGRAPH REPORT OF DELAYED TIME FREIGHT FORWARDED.

The following cars, Way-billed TIME FREIGHT, which have been delayed, were forwarded from_____Station _____19___

CODE LETTER AND NUMBERS			TIME FORWARDED	TRAIN NUMBER
Code Letter	From Lowest Number	To Highest Number		
B	C	D	F	G
			M	
			M	
			M	
			M	
			M	
			M	
			M	
			M	
			M	
			M	

(A)_____Yardmaster

(B)_____Agent

NOTE.—This form is used by agents and yardmasters to advise the car service agent by telegraph of the forwarding of delayed cars loaded with time freight; only the code letter, code number, time of forwarding, and number of train in which forwarded is transmitted. The report aids the car service agent in his supervision over time freight.

C. S. 21.

LIST OF FREIGHT CARS.

Box	Car.	Common type.
"	"	Furniture and Vehicles.
"	"	Wooden Ware.
"	"	Hearse.
"	"	Ventilated.
"	"	Ice.
"	"	Charcoal.
"	"	Lime.
Refrigerator	"	Common.
"	"	Beer.
"	"	Dressed Beef.
"	"	Dairy Products.
"	"	Ventilated Fruit.
Stock	"	Common.
"	"	Double Decks.
"	"	Single Deck Feed and Water.
"	"	Palace Horse with Stalls,
"	"	" Stock " "
Flat	"	Common.
"	"	Logging.
"	"	Barrel Racks.
"	"	Machinery.
"	"	Gun Trucks.
"	"	Water Tanks.
Gondola	"	Common.
"	"	Hopper Bottom.
"	"	" " Steel.
"	"	Drop Ends.
Ore	"	Iron, etc.
Tank	"	Oil, etc.
Live Poultry	"	
Ballast	"	
"	"	Distributers.
Lidgerwood Rapid Unloaders.		
Caboose	Cars.	
"	"	Stockmen's Sleepers
Excavator	"	
Derrick and Wrecking Cars.		
Pile Driver		"
Ditching		"
Side Dump		"
Rotary Snow Plow		"
Flanger		"

CHAPTER IV.

Particulars of Trains.

Car supervision implies multiplied duties and responsibilities. One duty is that of placing cars to meet business needs with the least haul and inconvenience to the service. Another duty is to see that they reach their destination safely and with due diligence. Another duty, and one of vital importance, is the effective operation of trains as regards speed, load and character. After all is said, it is from the train car service that earnings are derived, and all operating expenses incidentally flow. The train is but an aggregation of cars, and efficiency requires that it should be operated at such rate of speed as to prevent undue wear and tear of equipment and track, consistent with the needs of business.

It is also of the greatest possible importance in the effective and economical operation of railroads that trains should haul the full complement of cars and that these last should have full loads. That this is not possible in every case we all know, but every one connected with the service, nevertheless, strives in every possible way to approximate this ideal. And it is not too much to say that the measure of their success is dependent upon their watchfulness and experience and a due subordination of responsi-

bility. In order to accomplish the end sought and to determine the measure of success attained, more or less detailed information—of a statistical nature—is required. Of the nature and extent of such statistics there will be wide differences of opinion—as wide as the differences in men. One operating officer will require that his personal observations shall be supplemented by carefully collated returns of this nature. Another will make little use of such data except in aggregates, depending more largely upon his orders and watchfulness in enforcing the same, in reference to the particulars of trains. And statistics (it may be said for the thousandth time) are worthless except to those who will give them the time and study required to understand their import and apply the lessons they teach. If men will not do this statistics should not be compiled except as specifically called for: in that way much waste of clerical work and stationery may be avoided.

Thus it seems the extent and usefulness of statistical information—in regard to the operation of trains—depends on the peculiarities of those in charge. But in order to analyze the transportation service of a railroad effectively—on paper at least—full and accurate particulars of its train service, (according to its peculiarities) including mileage, cars hauled, load carried, etc., may be said to be absolutely essential. Such information, however, may be subdivided indefinitely according to the ingenuity of men and the use to be made of it. These subdivisions

I cannot attempt to follow. But primary details (fundamental things—things useful to know) relative to the train service, it is possible to give; and these I summarize herewith, without further remarks, for the benefit of those interested in such matters:

Total number of freight trains run, eastbound.*
(Or northward as the case may be.)
Total number of freight trains run, westbound.
Total number of freight trains run.
Average number of freight trains run daily, eastbound.
Average number of freight trains run daily, westbound.
Average number of freight trains run daily.
Total number of miles run by freight trains, eastbound.
Total number of miles run by freight trains, westbound.
Total number of miles run by freight trains.
Average number of miles run by each freight train, eastbound.
Average number of miles run by each freight train, westbound.
Average number of miles run by each freight train.
Average number of miles run by each freight train daily, eastbound.
Average number of miles run by each freight train daily, westbound.
Average number of miles run by each freight train daily.

(NOTE.—This information should be given for the road as a whole. But as neither the character of a road nor the details of its operations are the same for all its parts, the information in regard to the mileage of freight trains should be given separately for each division of a line, and—if circumstances require it—for each part of a division, such as spurs, mainline, etc. The foregoing also applies in regard to the data specified below. In other words, the information should be given for the railroad as a whole, and for such subdivisions thereof as the exigencies of the property require. It is only by subdividing the service of a railroad in this way that comparisons of the highest value are possible—for the reason that comparisons must be based on similar conditions. Thus, one part of a road may have a light traffic with heavy grades; another heavy traffic with light grades, and so on.)

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*The number may be for the week, month, year, or for any other period: and the same in regard to the averages called for further on.

Proceeding with the recapitulation of Exhibits, they should show:

Total number of loaded freight cars hauled in trains, eastbound.
Total number of loaded freight cars hauled in trains, westbound.
Total number of loaded freight cars hauled in trains.
Total number of empty freight cars hauled in trains, eastbound.
Total number of empty freight cars hauled in trains, westbound.
Total number of empty freight cars hauled in trains.
Total number of all freight cars hauled in trains, eastbound.
Total number of all freight cars hauled in trains, westbound.
Total number of all freight cars hauled in trains.
Average number of loaded freight cars hauled in each train, eastbound.
Average number of loaded freight cars hauled in each train, westbound.
Average number of loaded freight cars hauled in each train.
Average number of empty freight cars hauled in each train, eastbound.
Average number of empty freight cars hauled in each train, westbound.
Average number of empty freight cars hauled in each train.
Average number of all freight cars hauled in each train, eastbound.
Average number of all freight cars hauled in each train, westbound.
Average number of all freight cars hauled in each train.
Average number of loaded freight cars hauled in trains daily, eastbound.
Average number of loaded freight cars hauled in trains daily, westbound.
Average number of loaded freight cars hauled in trains daily.
Average number of empty freight cars hauled in trains daily, eastbound.
Average number of empty freight cars hauled in trains daily, westbound.
Average number of empty freight cars hauled in trains daily.
Average number of all freight cars hauled in trains daily, eastbound.
Average number of all freight cars hauled in trains daily, westbound.
Average number of all freight cars hauled in trains daily.
Total mileage of loaded freight cars, eastbound.
Total mileage of loaded freight cars, westbound.
Total mileage of loaded freight cars.
Total mileage of empty freight cars, eastbound.
Total mileage of empty freight cars, westbound.
Total mileage of empty freight cars.
Total mileage of all freight cars, eastbound.
Total mileage of all freight cars, westbound.
Total mileage of all freight cars.

Total mileage of home freight cars, eastbound.
Total mileage of home freight cars, westbound.
Total mileage of home freight cars.
Total mileage of foreign freight cars, eastbound.
Total mileage of foreign freight cars, westbound.
Total mileage of foreign freight cars.
Average mileage of loaded freight cars per day, eastbound.
Average mileage of loaded freight cars per day, westbound.
Average mileage of loaded freight cars per day.
Average mileage of empty freight cars per day, eastbound.
Average mileage of empty freight cars per day, westbound.
Average mileage of empty freight cars per day.
Average mileage of all freight cars per day, eastbound.
Average mileage of all freight cars per day, westbound.
Average mileage of all freight cars per day.
Average mileage of home freight cars per day, eastbound.
Average mileage of home freight cars per day, westbound.
Average mileage of home freight cars per day.
Average mileage of foreign freight cars per day, eastbound.
Average mileage of foreign freight cars per day, westbound.
Average mileage of foreign freight cars per day.
Average mileage of loaded freight cars in each train, eastbound.
Average mileage of loaded freight cars in each train, westbound.
Average mileage of loaded freight cars in each train.
Average mileage of empty freight cars in each train, eastbound.
Average mileage of empty freight cars in each train, westbound.
Average mileage of empty freight cars in each train.
Average mileage of all freight cars in each train, eastbound.
Average mileage of all freight cars in each train, westbound.
Average mileage of all freight cars in each train.
Average mileage of home freight cars in each train, eastbound.
Average mileage of home freight cars in each train, westbound.
Average mileage of home freight cars in each train.
Average mileage of foreign freight cars in each train, eastbound.
Average mileage of foreign freight cars in each train, westbound.
Average mileage of foreign freight cars in each train.
Total number of foreign freight cars in service on the system.
Total number of home freight cars in service of foreign roads.
Total number of miles run by foreign freight cars on the system.
Total number of tons hauled, eastbound.
Total number of tons hauled, westbound.
Total number of tons hauled.
Average tonnage—revenue and non-revenue—hauled in each train, eastbound.
Average tonnage—revenue and non-revenue—hauled in each train, westbound.
Average tonnage—revenue and non-revenue—hauled in each train.
Average revenue tonnage hauled per car, eastbound.
Average revenue tonnage hauled per car, westbound.

Average revenue tonnage hauled per car.
Total distance revenue tonnage was hauled (or—as it is termed in railway phraseology) 'The total number of revenue tons carried one mile', eastbound.
Total number of revenue tons carried one mile, westbound.
Total number of revenue tons carried one mile.

Information in regard to tons carried one mile is necessary to ascertain the average rate per ton per mile: information of value as generally indicating the comparative character of the traffic and the maintenance, or otherwise, of rates; and therefore of importance in comparing different, but generally similar periods.

The great value to a management of data along the lines outlined above, for exercising a minute supervision over operations, in the absence of other scources of information, cannot be overestimated. It affords information for analyzing conditions and making comparisons along generally similar lines that may be made very useful in scrutinizing the movement of cars and trains.

While the foregoing exhibits will greatly aid in watching the movement of freight cars and conditions of service generally, they are by no means complete. Thus, instead of being satisfied with the gross tonnage hauled, managers will require it to be classified as the peculiar traffic of a line suggests. If it is largely made up of ores, separate information will be required for such traffic; and so in regard to coal, live-stock, grain, timber, or other classes of freight that predominate and that must necessarily be shown apart from the balance in order to make exhibits of any value. I have made little attempt except to

show the performance of cars. The management of every road will however require not only information concerning such matters, but what the cars contained—Commodity statements in fact, showing the quantity of different classes of freight carried and the earnings derived therefrom. Such information is not only interesting but exceedingly valuable, especially when compared with corresponding periods indicating, as it will, whether particular kinds of traffic are increasing or falling off: and so I might go on indefinitely, if necessary, pointing out how exhibits of cars and the traffic they carry may be elaborated to meet particular conditions and the varied requirements of different managers.

What I have said in regard to exhibits for traffic and equipment in the schedule given above, refers wholly to Freight. But as a matter of fact the same information is required by a railway company in connection with its Passenger service; and along the same lines, as those I have specified. The differences are largely those of phraseology. However, where there are differences arising from dissimilarity of service, they will suggest wherein the formulas particularized above, will require to be changed or, perhaps, omitted altogether; and so I need not repeat a second time, the list already given in detail.

In reference to the technical classification of trains and, therefore measurably, of cars—I would respectfully refer the reader to the chapter treating of such matters with some considerable particularity, in another volume of the series of

"The Science of Railways." It is too lengthy to be repeated here and too involved to permit of any great abridgment.

In reference to exhibits of every kind, it may be said in conclusion, that their necessity, as a whole or in part, will be governed by the environment of each railroad, its organization, nature of equipment, character and direction of traffic, and other matters peculiar to its management and operations. Each company will require that which seems essential to its effective and economical working, eschewing those exhibits that do not appear to compensate for the clerical labor and other expense that they entail.

CHAPTER V.

Demurrage and Storage Service—Expediting the Loading and Unloading of Cars and Removal of Freight from Platforms and Warehouses.

A feature of great importance connected with the supervision of cars and their effective use, is the necessity there is to enforce reasonable promptness in loading and unloading the same. The cash value of the freight cars of railroads approximates a thousand-millions of dollars. These vehicles—this enormous sum—earn money only when in active use; when the cars have been loaded and are on their way to their destination. For tariffs are based on the haul (and the stipulated number of hours for loading and unloading) and make no provision for the length of time patrons have possession of cars outside of this limit. And because of this, and the dilatoriness of shippers, railroad companies have found it necessary to enforce a demurrage charge in those cases where unreasonable time is taken in loading or unloading.

The object of the demurrage charge or fine, whatever it may be called, is to expedite work at stations. For the charge of one dollar per day for delinquencies in no case covers what the car would earn if in use. For this reason it is

probable that the rules and regulations at present enforced throughout the country in this respect will not be permanent, but that experience and enlightenment on the subject will tend to their betterment in other directions—to the adoption in fact of more equitable rates and greater safeguards.

In the controversies that have arisen between carriers and the Government—abetted by shippers—in regard to demurrage charges, the latter has not insisted that such charges are unreasonable, but has claimed that the enforcement of them through car service associations was in the nature of a pool or trust, and therefore illegal. Whatever the outcome of the controversy may be, it cannot affect the principle that carriers are entitled to a fair rate of compensation for their cars when the users thereof are dilatory in loading or unloading them. The same is true in regard to neglect of merchants and others to remove their property from the warehouses and platforms of railroads.* It cannot be too strongly emphasized that full value is not exacted in the demurrage charge for the use of property. Its enforcement is primarily designed to compel reasonable diligence on the part of the patrons of railroads. Though there is no reason and can be none, why railroads should not have the full earnings value of every car detained beyond

* In connection with this charge, however, the Statutes of some of the States do not permit railroads to make a charge for warehousing—and thus the latter cannot offer such facilities to their patrons without wrong to themselves.

the necessary free time allowed for loading and unloading. Every minute that the facilities of a railroad company are thus tied up full compensation may reasonably be exacted. And that this right will ultimately be enforced seems reasonable.

The rights of railways, and the rights of the public who require cars—and are not always able to get them—demand that the least possible delay should occur in loading and unloading. Every moment beyond such period lessens the available equipment of a railroad and so restricts the supply—and, from the standpoint of the carriers, lessens the just profits of their business. Not only the rights of the carrier, therefore, but those of the public as well are dependent upon the exercise of due diligence on the part of those who use cars. But the interests of the latter, and those of the carrier frequently clash. Shippers may and do find it both convenient and profitable to load and unload cars at their convenience. The matter cannot, therefore, be left to their discretion without injustice to the carrier and the tying up of necessary facilities.

It is mere selfishness on the part of those who use cars to claim exemption from necessary rules and penalties; first, because of injustice to the railroads; and, second, because it deprives others of needed facilities—for a railroad company cannot keep in stock a sufficient supply of cars to answer both the purpose of transportation and storage. But whether the regulations necessary to prevent this are enforced by each

company for itself, or through an agent acting in common for all matters little if the principle is recognized as just. And if there is any law that prevents such enforcement—when exercised along just and equitable grounds—it is unjust and should be repealed. And it is probable that those who seek cover behind such a law do so with the knowledge that if enforced through the individual initiative of railroads, that the strife among carriers for business will open loop holes through which their patrons may hope to escape any charge whatever, either for delay in loading or unloading, or the undue use of platforms and warehouses. There can be no doubt that the adoption of the car service associations grew out of such strife among carriers.*

The propriety and reasonableness of railroads enforcing a charge for delays in loading and unloading cars has been made so apparent by the impartial enforcement of such regulations by the associations in question, that if they are abolished carriers—with the experience and enlightenment

*In reference to the introduction of the car service associations, a writer on the subject says:

"It was early recognized as a necessity that to secure the impartial enforcement of these rules (demurrage and warehouse, their supervision and application would have to be taken from the officers of the railways whose chief duty was to secure traffic, and likewise from those officers whose attention was so centered upon the movement of business in transit that the reasons which led to the detention of cars at destination received but secondary consideration. These causes led to the establishment of independent car service organizations at the more important traffic centers, especially charged with the supervision of the equipment at terminals; and to apply the rules uniformly upon all railroads centering at such points."

The duties assigned these associations were merely supervi-

they have had—will be able, by individual effort, to secure the same results. It would be folly to assume otherwise; that the experience and talent of the officers of railroads are not sufficient to meet such an emergency. It may be assumed therefore that reasonable charges for demurrage and warehousing have come to stay, and that nothing can permanently interfere with their just and active enforcement.

It may be said truly that the rates enforced for demurrage and storage are not based on the arbitrary dictum of the carrier, but in all cases bear just relation to the nature of the traffic and the value of the equipment—though, in no case, as I have stated, is the compensation adequate. Thus in the case of demurrage it is shown by the Interstate Commerce Commission that the earnings of a freight car exceed two dollars per day when in service, while the charge for demurrage enforced by the carrier does not generally exceed one-dollar per day. The loss entailed by the carrier he will suffer so long as he does not charge a rate commensurate with the earning

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sory; to see that there was no discrimination exercised in favor of particular shippers. It was their duty to see that the rates were uniform at particular centers and uniformly enforced. Moreover, they were entrusted with the duty of seeing that no injustice was done to the patrons of any railroad; or, in the event there had been, they were empowered and directed to correct it. The accounting connected with the associations was done by the railroad companies, each company making its reports and collecting the revenues within its own territory.

However, if through any cause the car service associations cease to exist because of Government prohibition or otherwise, the machinery operated by them may be operated—although perhaps not as effectively—directly by the employes of the railroad companies concerned.

capacity of the vehicle, when in use, less its wear and tear. Nor are there any just grounds for the claim that shippers should not be charged more per day for demurrage than railway companies enforce between each other for the use of their cars. In the former case there is no reciprocal accommodation while in the latter railroads use each others cars in common, and so derive a mutual benefit—the intent of the charge between railroads being mainly to prevent the user of a car allowing it to lie idle and so out of service rather than go to the expense of returning it to the owner.

With this explanation I subjoin the accompanying regulations regarding demurrage and warehousing without comment, it being understood that while they are actually in force today at great railway centers, they are inserted here as suggestive rather than being final and conclusive. For it is to be said of these rules, as of all others connected with railroads, that conditions govern; and so these regulations may be considered illustrative merely—as defining the rights of railroads under certain conditions—rather than authoritative.

All freight in carloads shall be subject to car service charges, and all freight held in railroad warehouses or on platforms shall be subject to storage charges, in accordance with the following regulations:

Forty-eight hours will be allowed for the loading or unloading of cars.

When the same car is re-loaded, ninety-si-

hours will be allowed for unloading and reloading.

Forty-eight hours free time will be allowed on storage tracks of railroads bringing cars into the territory covered by these rules for placing of reconsignment or switching orders, but this will not apply when cars are moved from one delivery track to another for accommodation of consignees.

Time will be computed from first 6 P. M. after arrival, when cars are held for orders, and from first 6 P. M. after placing on delivery tracks when held for loading or unloading, except as hereinafter provided.

(NOTE.—The rules for computing time vary somewhat in different localities. Thus in one section the charge is from 12 o'clock noon on cars arriving during the forenoon; and from 7 the following day if they arrive after 12 o'clock noon.)

In computing time, Sundays and the following holidays are exempted: New Year's Day, Lincoln's Birthday, Washington's Birthday, Decoration Day, Fourth of July, Labor Day, Thanksgiving Day, Christmas Day, and all general and municipal election days. When a legal holiday falls on Sunday, the following Monday will be exempted.

Cars containing grain in bulk will be allowed forty-eight hours free time for disposition from 12 o'clock noon of the day of arrival, provided the grain is subject to inspection and is inspected before 10 o'clock A. M. of that day. If inspection is made after 10 A. M., car service will begin forty-eight hours from 12 o'clock noon of the following day.

Grain ordered to elevators located on tracks of the railroads bringing the cars into the territory covered by these rules will be held ten days free of car service from first 6 P. M. after orders are filed with local agent.

Grain from connecting lines consigned or ordered to elevators, will be held 10 days free of car service from 6 P. M. of date of receipt by the railroad delivering to elevator.

Grain from connecting lines held for disposition will be allowed forty-eight hours free time from first 6 P. M. after receipt of cars by secondary line for the placing of final billing directions with billing agent.

Grain loaded at elevators will be allowed forty-eight hours free time from first 6 P. M. after cars are loaded, for placing billing directions with billing agent.

(NOTE.—In one locality no charge is made on grain for delivery at public elevators; but when it is held out of elevators by order of shipper or consignee, it is subject to the same rules as other freight.)

Cars loaded with baled hay and straw, will be allowed forty-eight hours free time from first 7 A. M. after being placed on track in delivery yard, for the placing of orders. Forty-eight hours additional free time will be allowed for unloading, computing time from first 6 P. M. after order is filed at local office.

Cars loaded with coal and coke may be held on storage tracks of the railroads bringing cars into the territory covered by these rules for a period of seven (7) days free time for disposition.

(NOTE:—Seven days free time is allowed for disposition of coal and coke to insure a supply of fuel at all times in the large cities and manufacturing centers, and to provide for irregularities in transit incident to low class freight moving long distances The rule is so worded that seven days is the maximum time as roads that originate coal at short distances do not find it advisable to allow the full seven days. In another place cars loaded with coal and coke may be held on storage tracks seventy-two hours; and afterwards forty-eight hours on unloading tracks before demurrage is assessed; the same rule applies to bulk salt, lime, ore, and fluxing materials.)

Cars loaded with freight in bond will be allowed forty-eight hours free time for unloading after release by United States Customs officer.

Cars containing freight held for billing, milling, shelling, cleaning, sacking, or for change of load by owner or his agent, will be subject to car service if held in excess of forty-eight hours, and if such shipments are transferred to other cars, the charge will continue on cars to which transfer is made, and must be collected or billed as cash advances.

Cars billed to order, when held for bills of lading or instructions are subject to car service charges at the expiration of forty-eight hours from arrival, and car service must be collected before delivery of the freight.

When cars are held for payment of freight charges, car service will be assessed at the expiration of forty-eight hours from arrival.

Cars must not be held back from, or outside of, place to which they are consigned, for the purpose of evading car service charges. When cars are held by reason of consignee not being ready to receive them, the agent shall include such cars in his car service report, and demurrage shall be charged thereon as provided in the rules.

When any consignee is unable to receive freight or to unload cars, and, for that reason, the delivering line refuses to receive cars from connecting lines consigned to such consignee, the agent of such connecting line or lines holding cars for such consignee shall immediately notify the consignor or consignee of the cars so held, and of the inability to forward or deliver the same, and shall charge car service, if delivery cannot be effected within free time allowed for reconsignment.

At the expiration of free time (i. e., the time allowed the patron by a company to load or unload a car) a charge of one dollar per car per day,

or fraction thereof, must be collected for detention of all cars held for loading or unloading, or subject to order of consignors, consignees or their agents.

When both cars and tracks on which cars are held are owned by the same party, not a railroad company, no charge will be made; but when private cars are detained on tracks of other firms or individuals, or on tracks belonging to or operated by railroads within the territory covered by these rules and subscribing thereto, the established charge shall apply.

Storage will be charged when freight unloaded at railroad warehouses or platforms is not removed by consignee within forty-eight hours from first 6 P. M. after cars are unloaded.

Freight in cars placed on delivery tracks and subsequently sent to railroad warehouses or platforms, is subject to car service rules while on delivery tracks, and storage rules after cars are unloaded at warehouses or platforms.

Freight upon which the free time has expired while on delivery track, and subsequently sent to warehouses or platforms, shall be subject to storage charge immediately when unloaded at warehouses or platforms.

Freight received for shipment at railroad warehouses or platforms will be charged storage, if held more than forty-eight hours from first 6 P. M. after receipt, to complete a shipment or for forwarding directions.

When freight is held in railroad warehouses or on platforms in excess of free time, charge will be made for storage at the rate of five cents per ton per day.

Any fractional part of two thousand pounds

will be computed as a ton, and any fractional part of twenty-four hours will be computed as a day.

A minimum storage charge of five cents per day will be made on each consignment of freight of less than two thousand pounds.

(NOTE.—Storage rules, it may be said, are necessary to the fair and impartial application of the car service rules; also, to prevent congestion at freight houses, by enforcing prompt removal of freight.)

Cars containing freight to be delivered from track warehouses or platforms, shall be switched immediately on arrival, or as soon thereafter as the usual routine of yard work will permit.

The delivery of cars consigned, or ordered, to private tracks or designated public delivery tracks, shall be considered to have been effected when such cars have been placed on the tracks designated, or, if such tracks be full, when the road offering the cars would have made delivery had the condition of such tracks permitted.

Agents must collect car service charges regardless of the state of the weather, unless exemption is authorized by the official having the disposition of such matters.

Live stock and material belonging to the railroad shall be exempt from car service rules, and shall not be included in reports.

Car service (demurrage) and storage charges must be collected in the same manner and with the same regularity and promptness as transportation or switching charges.

Freight upon which car service or storage charges have accrued shall not be removed from the railroad company's premises until the charges thereon have been paid. When consignors or consignees refuse to pay, agent will hold freight

until payment is made and assess regular charges until the freight is removed; or, at his option, he may send freight to a public warehouse or yard, where the same must be held subject to storage charges, in addition to all other charges.

When cars are detained on private tracks beyond the free time for loading or unloading, and payment of car service charges is refused, agents must, after giving five days' notice, decline to switch cars to private tracks of such parties; and thereafter tender freight from public team tracks, and collect freight charges before delivery, until satisfactory guarantee is given that the car service rules will be complied with; the official in charge of such matters must be promptly advised of such action.

When grain is held for an elevator in excess of free time, car service charges must be collected from the elevator.

Car service charges due for detention of cars ordered to connecting lines within the switching limits of the territory covered by these rules shall be collected by the agent of the forwarding line. When cars are ordered or destined to points beyond switching limits, the agent, at his option, can collect from shipper or consignee, or let the charges follow as advances.

All claims for relief from, or refund of charges collected under these rules, and all other claims shall be referred with full explanations to the official in charge of demurrage and storage service.

Agents of railroads must make and send to the official in charge of demurrage and storage a record of all freight subject to car service and storage rules, on such forms and in such manner

as may from time to time be prescribed, and give such other information in relation to car service and storage as may be required.

The foregoing rules are complete in themselves. Usages, however, differ according to conditions and measures. Thus, at one point two cents per cwt. will be charged for storage on potatoes, apples and other similar products for the first week, and three-fourths of a cent for each succeeding week or fraction thereof; on canned goods, sugar, and other specified articles, the rate will be one and one-half cents per cwt. for the first week, and so on. Another group of railways will charge one cent per cwt. on all classes of freight with a minimum of ten cents for any one consignment, and a maximum therefor of one dollar per day. Still another group will—because of lack of facilities—make it a rule to deliver all packages of freight at a public warehouse at the expiration of free time allowed consignees. In all cases however the charge is along well considered lines and is both reasonable and proper.

In the enforcement of the regulations governing demurrage and storage charges, careful provision is made to prevent injustice being done to the patrons of railways, such as a charge for detentions for which they are not responsible. Reasonable concessions are also made in regard to time allowed for loading and unloading particular classes of freight. In every case the carrier is quick to accord relief where an unjust charge has been made.

Prior to the arbitrary enforcement of demurrage and storage charges an intolerable misuse of freight cars prevailed. Consignees, with no other place of business than a desk, perhaps, would receive freight in car-lots and upon its arrival, failing to find a customer, would hold the cars on the track until they were able to dispose of the freight. Or, after exhausting the patience of one carrier, would, upon payment of a small switching charge, move the car to the tracks of another company and so repeat the delinquency. It often fell out in the case of delays, that the contents of the car would so depreciate in value that the railroads could not realize, by enforced sales, sufficient to pay their just charges. Buyers, emulous of gain, would order large supplies in order to take advantage of a favorable market and, on arrival of the goods, owing to lack of storage facilities, would leave the freight on the tracks, or in the warehouses of the company. A very large percentage of the freight received by carriers at large centers, is deliverable in car lots upon the tracks of other companies. Prior to the enforcement of fixed regulations governing demurrage a serious condition confronted the owners of cars passing to connecting lines. Thus, a car owned by the Erie would be switched to the track of another road having a corresponding terminal, with the result that there being no arbitrary rule in regard to the return of the car, it would fall out that the Erie would be, little by little, divested in this way of its rolling stock

and so unable to afford accommodations to its patrons.

In conclusion it may be said in regard to the enforcement of arbitrary regulations governing demurrage, that in 1888, prior to such enforcement, the average detention of a car by patrons, was five days. In 1903, after fifteen years of definite enforcement of such rules, the average was reduced to 1.69 days per car. This gain—on the basis of the freight car equipment of railroads—was equal to an addition of 315,923 cars to the equipment of American railways, and to that extent afforded those who use freight cars that additional accommodation over old conditions. From whatever point viewed the due enforcement of demurrage charges may be said to be a public and private necessity; it lessens waste of needed facilities and in a measure protects the just rights of the carrier.

CHAPTER VI.

FORMS USED IN SUPERVISING AND ADMINISTERING THE DEMURRAGE AND STORAGE SERVICE.

NOTE.—The accompanying blanks fully explain their purpose and how compiled. They are adaptations of those found to be of practical utility and are available without any change whatever for use by Car Service associations, or directly, by a railroad company, if it desires to enforce its demurrage and storage charges through its own officers and employes.

Form No.

D-S. 1. STATION RECORD OF CARS SUBJECT TO CAR SERVICE.

D-S. 2. AGENT'S DAILY REPORT OF CARS RECEIVED, ORDERED, PLACED AND RELEASED.

D-S. 3. NOTICE TO AGENT OF ERRORS AND OMISSIONS IN HIS DAILY CAR SERVICE REPORT.

D-S. 4. HEADQUARTERS RECORD OF CAR SERVICE.

D-S. 5. AGENT'S WEEKLY STATEMENT OF CAR SERVICE CHARGES COLLECTED.

D-S. 6. AGENT'S MONTHLY STATEMENT OF UNCOLLECTED CAR SERVICE CHARGES.

D-S. 7. MONTHLY STATEMENT FOR THE RAILROAD COMPANY OF CAR SERVICE CHARGES CHARGEABLE AGAINST ITS AGENTS.

D-S. 8. AUTHORITY (IN DUPLICATE) FOR AGENT TO REFUND CAR SERVICE CHARGES.

D-S. 9. AUTHORITY TO CANCEL CAR SERVICE CHARGES.

D-S. 10. AGENT'S DAILY REPORT OF CHARGES ASSESSED FOR STORAGE OF FREIGHT.

D-S. 11. AGENT'S WEEKLY STATEMENT OF STORAGE CHARGES COLLECTED.

D-S. 12. AGENT'S MONTHLY STATEMENT OF UNCOLLECTED STORAGE CHARGES.

D-S. 13. MONTHLY STATEMENT FOR THE RAILROAD COMPANY OF STORAGE CHARGES CHARGEABLE TO ITS AGENTS.

STATION RECORD OF CARS SUBJECT TO CAR SERVICE. D-S-1.

NOTE.—This book is used by agent for purpose of recording the movement of cars at stations, subject to Car Service rules. It is written up from day to day as the service progresses.

CAR		CAR RECEIVED			CAR ORDERED		CAR PLACED		CAR RELEASED		Car Service Charge	Location of Car	Contents of Car	Consignee or Consignor
No.	Initial	From	Date	Time	Date	Time	Date	Time	Date	Time				

D-S-2.

AGENT'S DAILY REPORT OF CARS RECEIVED, ORDERED, PLACED AND RELEASED.

To_____ _____ Station_____ R. R.

_____

_____

Dear Sir: Below please find statement for the 24 hours ending 6 P. M., _____ 19___

_____ Agent.

_____

NOTE.—This report must be made daily (except Sundays). Monday's return will include Sunday's business. It must be forwarded in time to reach the proper official not later than 48 hours after the period for which it is made.

Empty cars placed for loading should be designated in the 'Received' column thus: "X." In reporting cars released agent must furnish complete record of each car, date and time received, date and time ordered, date and time placed, with contents, consignees and amount of car service.

There should be no charge made for the days cars are detained by railroad company.

CAR		RECEIVED			ORDERED		Detention by R. R. Co.	PLACED		RELEASED		Public or Private Track	Contents	CONSIGNEE OR CONSIGNOR	Car Serv. Charge
Number	Initial	From	Date	Time	Date	Time		Date	Time	Date	Time				

B-S-3.

NOTICE TO AGENT OF ERRORS AND OMISSIONS IN HIS DAILY CAR SERVICE REPORT.

_____ 19____

To_____ ____Agent,_____ _____ _____Railroad Co.

At_____ _____ _____Station.

On receipt of this form, the agent will sign his name thereto and return the original to the maker (retaining the duplicate for file) provided charges as corrected are in accordance with the record. If not correct, the original and duplicate should be returned with explanation.

_____

YOUR DAILY CAR SERVICE REPORT FOR CARS RELEASED 6 P. M._____19 reads as follows:

CAR No.	CAR Initial	RECEIVED	ORDERED	PLACED	RELEASD	Car Ser. Charge	CONTNTS	CONSIGNEE

IN CONFORMITY WITH THE CAR RECORD, THE CHARGE AGAINST YOUR STATION HAS BEEN CHANGED TO READ AS FOLLOWS:

HEADQUARTERS RECORD OF CAR SERVICE FOR STATION NAMED. D-S-4.

For _____ R. R. _____ Station. Agent. _____ 19___

CAR		RECEIVED		ORDERED		PLACED		REL'SD		Con-tents	Con-signee	DEBITS	CREDITS			Car Serv. Refunds	CLAIM	
Number	Initial	Date	Tm	Date	Tm	Date	Tm	Date	Tm			Car Ser. Charge	Car Ser. Collected	Car Ser. Cancelled	Date		No.	Date

D-S-5.

AGENT'S WEEKLY STATEMENT OF CAR SERVICE CHARGES COLLECTED.

_____ Station, _____ 19____

To _____

_____

Dear Sir:

The following is a statement of car service charges collected by me for the week ending _____ 19____ for _____ R. R. Co.

_____ Agent.

Collections should not be included until final release of car.

NOTE.—This return is necessary in writing up record form 4 at Headquarters.

CAR NUMBER	INITIAL	DATE RELEASED	AMOUNT COLLECTED	FROM WHOM COLLECTED

D-S-6.

AGENT'S MONTHLY STATEMENT OF UNCOLLECTED CAR SERVICE CHARGES.

To_____ _____ 19___

Dear Sir:—

Below please find statement of all uncollected car service charges due_____ R. R. Co.

at_____ Station, for the month of____ _____ 19___

_____
Agent.

(NOTE.—This report must be made immediately after close of month.)

_____
Station.

CAR NO.	INITIAL	WHEN RECEIVED		WHEN PLACED		WHEN RELEASED		AMOUNT OF CAR SERVICE CHARGE	FROM WHOM DUE	WHY NOT COLLECTED
		Date	Hour	Date	Hour	Date	Hour			

D S-7.

MONTHLY STATEMENT TO THE RAILROAD COMPANY OF CAR SERVICE CHARGES CHARGEABLE AGAINST ITS AGENT.

To_____ _____ 19__

Accounting officer of

_____ R. R. Co.

Dear Sir:—

The following is a statement of CAR SERVICE CHARGES at_____ Station, for month of _____ 19__, which please charge to_____ Agent.

(NOTE.—One copy of this is sent to the accounting officer of the road; one copy to the agent interested; one copy is filed in the office (by the official in charge) where the statement is compiled).

CAR NO.	INITIAL	DATE REL'SD	CAR SERVICE	CAR NO.	INITIAL	DATE REL'SD	CAR SERVICE

D-S-S.

AUTHORITY (IN DUPLICATE) FOR AGENT TO REFUND CAR SERVICE CHARGES.

ORIGINAL.

_____ 19___

To_____

Agent_____ R. R. Co. Claim No._____

_____Station.

DEAR SIR:—

You will please refund to_____ the following amounts collected by you account of car service on cars enumerated below. Please be particular to take receipt in duplicate (on forms herewith), allowing no alteration or erasure to be made thereon. When settlement has been effected, send original receipt to the accounting officer of your company and the duplicate to this office, together with all papers connected with the claim.

CAR		CAR SERVICE	
Number	Initial	Amount Collected	Amount to be Refunded

RECEIPT.

_____Station_____ 19___

Received of _____Agent, the sum of

_____Dollars, ($_____)

in payment of amount referred to in the above statement, and in full settlement of claims for the cars mentioned.

_____

0-8-0.

AUTHORITY TO CANCEL CAR SERVICE CHARGES.

_____ 19____

To_____Agent. Claim No._____

of_____R. R. Co._____Station.

Dear Sir:

You are hereby authorized and directed to cancel car service charges assessed against the following cars account of

_____

NOTE.—You will send this sheet to the accounting officer of your company as your authority for cancelling the charges enumerated below.

Yours truly

_____

_____

Car Number	Initials	Amount Assessed	Amount to be cancel'd	Date Released	REMARKS

Claim No._____

_____R. R._____Station._____19____

To_____

_____

Dear Sir: In accordance with the authority contained in your order of _____19____, I have this day canceled $_____ car service charges mentioned therein, and herewith return to you all papers connected with the claim.

_____Agent.

NOTE.—Agent will fill up this form and detach and forward as indicated.

D-S-10.

AGENT'S DAILY REPORT OF CHARGES ASSESSED FOR STORAGE OF FREIGHT.

To_____ **Sheet No.**_____

_____ _____**Station,**_____**Railroad.**

Dear Sir—Below please find statement of charges assessed for storage of shipments forwarded and delivered during 24 hours ending_____**19**___ _____**19**___. _____**Agent.**

[NOTE.—**All shipments delivered or forwarded on which storage charges have accrued must be reported on this form.** The report must be made daily (Sundays and holidays excepted as provided by the rules) and forwarded promptly to the official in charge. Shipments delivered on Sundays and holidays will be included in report for previous day. Agents will use only columns 2 to 9, inclusive (headed "Station Record"). In reporting freight delivered, date unloaded and date delivered will be shown in columns 5 and 6; for freight forwarded, date freight is received and also date final billing directions are received will be entered in columns 5 and 6. For reporting shipments forwarded, the way-bill number should be entered in "Pro." column 4, designating such freight by letters "O. F." in column 1. Letters "C. L." should be inserted in column 15 when carload freight is reported. Supplementary reports for all shipments omitted from regular reports should be made. The records as shown on this report will be checked at headquarters by the official in charge of Car Service matters. If charges are not in accordance with the rules, agents will receive notice of correction. A copy of this report should be kept on file in the office of agent making the same. Sheets must be numbered consecutively, beginning with No. 1, the first of each month.]

STATION RECORD									HEADQUARTERS RECORD					
1	2		3	4	5	6	7	8	9	10	11	12	13	14	15
	CAR		Storage Pro.	R.R. Pro.	Date Unloaded or Received for Shipment	Date Del. or Receipt of Forwarding Instructions	CONSIGNEE OR CONSIGNOR	WEIGHT	Storage Charge	Collections	Date	CLAIM			Car Load
	No.	Initial										Relief	Refund	Number	

D-S-11.

AGENT'S WEEKLY STATEMENT OF STORAGE CHARGES COLLECTED.

To_____, _____ 19___

Dear Sir:

Below please find report of storage charges collected at _____ Station,

_____ Railroad, for week ending _____ 19___

(NOTE.—This report must be closed at 6 P. M. on the 7th, 14th, 21st and last day of each month, and forwarded by agent promptly to the official in charge at Headquarters.)

_____ Agent.

_____ Station.

CAR NUMBER	INITIAL	RAILROAD PRO.	CAR SERVICE PRO.	DATE FREIGHT DELIVERED OR FORWARDED		AMOUNT COLLECTED		FROM WHOM COLLECTED

D-S-12.

AGENT'S MONTHLY STATEMENT OF UNCOLLECTED STORAGE CHARGES.

_____ Station _____ 19____

To _____

_____

Dear Sir:—Below please find statement of all uncollected storage charges due _____

R. R. Co. at _____ Station on the last day of _____ 19____.

(NOTE.—This report must include all unpaid storage charges whether same have been previously reported or not. It must be forwarded promptly at the close of each month to the official in charge).

_____ Agent.

CAR NUMBER	INITIAL	RAILROAD PRO.	CAR SERVICE PRO.	DATE FREIGHT DELIVERED OR FORWARDED		AMOUNT DUE		FROM WHOM DUE	WHY NOT COLLECTED

D-S-13.

MONTHLY STATEMENT TO THE RAILROAD COMPANY OF STORAGE CHARGES CHARGEABLE TO ITS AGENT.

To_____ _____ 19____
Accounting Officer of the_____ R. R. Co.

DEAR SIR:

The following is Statement of STORAGE CHARGES at_____ Station which please charge to_____ Agent of_____ R. R. Co. for month of_____ 19____

W-B. or PRO. NUMBER	WEIGHT	DATE RELEASED	AMOUNT CHARGED	W-B. or PRO. NUMBER	WEIGHT	DATE RELEASED	AMOUNT CHARGED

NOTE.—This return is made in triplicate by the official in charge of storage matters: one copy he retains; one copy he sends to the agent interested; the other copy he sends to the accounting officer of the railroad company so that the amount may be audited and charged to the agent.

CHAPTER VII.

Joint Use of Cars by Railroads and the Supervisory Accounting Occasioned Thereby.

The wide use of cars in common by the railroads of America renders the duty of watching over them one requiring systematic method and painstaking care. In the early days of railways inter-road freight was rebilled and, in the main, reloaded at the point where it was to leave one railroad for transportation on another. Now, much of this freight is billed through, the car in which it was originally loaded being transferred to the connecting road, and so on to the final destination.

And wherever there is a railroad of standard gauge connecting with other roads, there we will find this community of interest, this neighborly exchange of facilities, this avoidance of delays.

In America no distance is too great, no locality too remote, it may be said, not to be visited, more or less often, by the cars of railroads at the farthest extremity of the continent. Because of this wise provision it is as if one company owned all the equipment and operated it in common for the general good. This great convenience and saving in time the railroad companies afford the business world: and thus they are breaking down the barriers that have existed between the dif-

ferent countries, and with them the national enmities and prejudices that have prevailed in the past. For these cease to have force when those who possess them discover the advantages that attend free international intercourse; and the fact that trade flows back and forth across our National borders with unimpeded freedom—so far as carriers are concerned—is abundant evidence that the inhabitants of the countries, to the north and south, find advantage as do our own people in such interchange of commodities. And from a merely sentimental point, what American's heart has not beat the faster when, in some far-off place, his eyes have suddenly been gladdened with the sight of a railway car that comes from his own neighborhood and that is as familiar to him as his doorpost!

Thus the cars of standard roads intermix, traversing every part of the continent—and so far as the observer can see—seemingly lost to the supervision of their owner. But as a matter of fact, he, through his officers never for a moment loses sight of his property, nor ceases to jealously watch its whereabouts, nor, finally, fails to enforce compensation for its use. Not only that, but he insists upon its being returned within a reasonable time. The enforcement of this necessary procedure he entrusts to men experienced in such matters, and it is their duty to see that, when a car has performed its allotted burden, it is sent home. Another duty, and analogous to this, that the owner of cars performs, is that of keeping a watchful eye over the cars

of other companies that he may, for the moment, have on his line. These he requires shall be sent home with all possible expedition, that the charge for their use and the fines inflicted for undue detentions, may not be burdensome or out of proportion to the value his company has received from the use of the cars. In this duty, as in that of watching over the cars of his company on other roads, the owner enlists the co-operative effort of all his officers and employes who are in any way charged with the movement of cars.

Two phases of the subject present themselves in connection with the use of cars by railroads. One the handling or distribution thereof as required by the needs of business; the other, the compiling of such accounts and returns as may be necessary to fix the balances that railway companies owe each other for the joint use of their respective cars.

On some roads these duties are merged under one officer; but as railroads have increased their mileage and the number of their cars, some of them have divided the work, placing the first named under an officer more or less commonly known as the Car Service Agent; and the second under an official we may call the Auditor of Car Accounts. This division of work has been made for the reason that the distribution of cars (placing them where needed) is an operating or executive function requiring that the responsible official shall keep himself actively informed of the business needs of the road by being in touch with the forces responsible for its traffic and the

expeditious and economical handling of the equipment in the discharge of business. On the other hand, the keeping of the accounts and records necessary to determine balances due to and from railroads is of a clerical nature, like all other matters connected with the Accounting Department. It is the duty of the official in charge of this work to see that accurate account is kept of the cars interchanged by railroads and that due compensation is rendered therefor.

It is because of the dissimilarity of the duties and responsibilities connected with the two classes of work that the division of the work referred to above has been made. For it has been found by practical experience that an officer especially qualified to attend to the handling and distribution of cars is, through temperament and concentration of his mind in other directions, oftentimes not as well qualified to look after the accounts (bookkeeping) as an officer schooled in such matters and giving the subject undivided attention. However, wherever these widely different qualities or capacities of mind and energy are possessed by one man, the division of the work as pointed out, will not be so apparent.

The duties of the Car Service Agent, I have endeavored to describe with some particularity elsewhere. Those that are or may be assigned to the Auditor of Car Accounts, as above explained, with the forms necessary to a proper discharge of the work are described further on. One of his duties, and perhaps the most important, relates to the keeping of the records

and accounts of the amount his company owes to other companies for the use of their cars, and vice versa. These I take up first. And it may be said in this connection that there are two bases of settlement for the joint use of cars by railroads. That based on the mileage they make on the road using them; and that based on what is known as the per diem system—the latter an agreement to pay a stipulated amount for each car each day that it is in the possession of the using company. The first method has been largely supplanted in America by the second. This because under the first named, due responsibility cannot be fixed nor active effort be assured, on the part of the using company, that it will return the car at the earliest practicable moment. Of the mileage system, too, a belief or suspicion sometimes arises—not well founded perhaps—as to whether the using company is always careful to report the full mileage made; also doubt as to whether the system of accounts necessary to secure full returns is as comprehensive and as rigidly enforced as it should be. Moreover as a company under that method of compensation, does not have to pay for the use of a car except on the basis of mileage—i. e., when it is in active use—it follows that there is no particular urgency on the part of the using company to return it to the owner when idle; and when local business presses foreign cars are, as a matter of convenience and excusable thrift, allowed to lie on the sidings awaiting a more convenient season to be returned to the owner. The

mileage system, while admirable in theory, and also in practice in many particulars, does not, it is apparent, adequately protect the owner of cars in use by other companies. And it is no justification of the system to say that all companies being equally lax, equally neglectful in handling the cars of other companies, the owner is protected because of the uniformity of the practice—in other words he being as negligent in handling the cars of other roads as they are in handling his, the loss is in that way made good.*

In introducing the Per Diem system covering the joint use of cars, the rate agreed upon, (of 20c per day to be paid to the owner of the car,) it is unnecessary to say was not entirely satisfactory. Each company was governed in the matter wholly, of course, by self interest—by its environment. Some claimed the rate was too low, others that it was too high. And it is, perhaps, not too much to say that no rate that ever will be agreed upon will be entirely satisfactory. Some will think it is excessive, others the reverse. And the same may be said in regard to the rates—some of which are particularized herein—for the use of trains, locomotives, tracks, fines for holding cars, and so on. And because of this they are not given herein as authoritative or likely to be permanent. They are intended to be

* More particular reference to the mileage basis as a method of settlement between railroads for the joint use of cars, is referred to in another volume of the "Science of Railways." While other methods that may be enforced with greater surety will be adopted more or less generally as a substitute for the mileage basis, it will, nevertheless, always be in some favor.

illustrative merely; to approximately represent what carriers, under certain normal conditions, may agree among themselves to pay for certain privileges, rights and usages.

This is also true, too, of any rates that may be agreed upon between companies in regard to compensation for handling engines, trains, crews, and loaded and empty cars, belonging to other companies. Like all other things they are adjusted to meet conditions; to conform to the law of demand and supply. Such being the case it will be understood, therefore, that wherever specific figures are used herein, they are intended to be illustrative rather than fundamental.

A necessary feature of great interest in connection with the supervision of cars, that I may mention before proceeding, is the preservation of the history of each car; the time it was built, when destroyed, when replaced, and other particulars regarding its character. The accompanying form has been found to answer the purpose of a record. It may be called an

HISTORICAL RECORD OF CARS.

Car No. 1	Date Car Was Built	Where Built			Inside Dimensions			Capacity Tons	Changed		Date	
					Length	Width	Height		From	To		
	Date Broken Up	Where Destroyed	Date Rebuilt	Where Rebuilt								

This record contains the history of every car owned by a company. It is valuable for purpose of reference, and the officer who has it in charge is notified, without delay, both of the building and destruction of cars. And naturally it is to him that the superintendent of cars will go when he wishes to number a car or group of cars; for only the keeper of the record has knowledge of the vacant numbers available for such use.

The accounting connected with the joint use of cars, because of the wide territory they traverse and the great number of vehicles thus employed, requires minute and comprehensive oversight. Methods must be such as to follow the car day by day to see that the amount justly due the owner is made a matter of record and finally accounted for. The report (monthly settlement account) of a company for such use of cars is, for the moment accepted, as correct and the balance between the two roads concerned is struck on that basis. But afterwards the statement is carefully scrutinized, item by item, and in the event of any error or omission, the company rendering the report is duly notified and requested to add to or deduct from its next report the amount of the mistake. The reports thus passed between companies, with other exchanges concerning details, afford all the information necessary to a proper supervision of the work from day to day, and finally a correct audit of the accounts at the end of the month. When the balance for or against a company is ascertained, it is certified to the proper official for final set-

tlement and thus a balance is struck and the creditor company draws, without notice, for the balance due it. In respect of this it does not matter whether the accounts are arrived at on a mileage or per diem basis. Whatever amount a company owes the other, including penalties and rebates (called reclaims), is included in the monthly statement, and forms a part of the balance drawn for.

The work of compiling and auditing these returns falls to the Auditor of Car Accounts and it is he who certifies the balances for settlement between the companies. And as the method of settlement in America, for the joint use of cars, will be based more or less generally on the per diem system, particulars concerning such method are at once interesting and of common use to all having anything to do with railway equipment or accounts. The details connected with the system may properly be prefaced by explaining the few and simple definitions that have been agreed upon in the technical nomenclature of the system. Thus, in returns and correspondence in reference to the joint use of cars the term

Home Car—Is everywhere understood to mean a car on the road to which it belongs.
Foreign Car—A car on a road to which it does not belong.
Private Car—A car having other than railroad ownership.
Home—A location where a car is in the hands of its owner.
Home Road—The road which owns a car, or upon which the home of a private car is located.
Home Route—The line of intermediate roads over which a foreign car was moved from home.
Home Junction—A junction with the home road.
Home Route Junction—A junction on the home route.

Switching Service—The movement of a car (by another company) that is to be loaded or unloaded; also the movement of a car between railroads—all within designated switching limits—for which a charge is made against the road performing the service—such road not participating in the earnings that accrue from transporting the freight, but deriving a revenue from the switching service it performs.

The rates enforced in connection with the per diem system, like all regulations regarding the interchange of equipment and traffic between railroads, will be changed, as already pointed out, from time to time—or abrogated entirely—according to the interest of the companies interested. But the rules and regulations—or formulas—governing the business, like all such regulations, can never vary greatly. Indeed, they must of necessity be substantially the same. For that reason the methods devised by the railroad companies interested, governing the enforcement of the per diem system, given below, will always be interesting and, in the main, accurate.

The following are the provisions in question, omitting the rates which, as we know, will ever be a changeable quantity:

REGULATIONS GOVERNING SETTLEMENTS BETWEEN RAILWAY COMPANIES, FOR THE JOINT USE OF FREIGHT CARS, ON THE PER DIEM BASIS.

1. The rate for the use of freight cars shall be — cents per car per day, which shall be paid for every calendar day, and shall be known as the per diem rate.

2. Days shall be reckoned by subtracting the date of receipt from the date of delivery. The day of receipt shall be disregarded, and payment made for day of delivery.

A road receiving and delivering a car on the same date shall not pay the per diem for that day.

3. A road shall have the right to demand the return of its car after it has been twenty days consecutively on any road. If the car is held by that road more than ten days after the date of such notice—on the prescribed form—making thirty days in all, thereafter a penalty rate of — cents per day in addition to the per diem rate shall be paid by such road for the further use of that car.

4. All railroads, including ferry lines, shall be responsible to the car owner for amounts accruing for the use of a car at the established rates, whether such car is in road service or switching service, until the car has been delivered to the owner or to another road.

5. An arbitrary amount (previously agreed upon) for each car in switching service—held beyond a stipulated time—may be "reclaimed" (exacted) by the switching line, from the road for which the service was performed. The amount is based upon the average number of days actually required to perform the service, as agreed upon beforehand by the roads directly interested, for the territory in question. (See definition of "Switching Service.")

6. Cars shall be considered as having been

delivered to a connecting railroad when placed upon the track agreed upon and designated as the interchange track for such deliveries—accompanied or preceded by proper data for forwarding—and accepted by the car inspector of the receiving road. Unless otherwise arranged between the roads concerned, the receiving road shall be responsible for the cars, contents and per diem, after receipt of the proper data for forwarding and until they have been accepted by its inspector or returned to the delivering road.

7. In case a road delivers an empty foreign car without the consent of the owner to a road which does not pay per diem—or if a road permits the loading or re-consigning of a foreign car without the consent of the owner to such a road —it shall be responsible to the owner for the payment of an amount equal to the per diem accruing on the car while on such road.

8. When home route cards have been requested under the master car builders' rules, the per diem shall cease from the date of request to owner.

When a car has been destroyed and reported under the master car builders' rules the per diem shall cease from the date of notice to owner.

9. When a car is detained awaiting receipt of repair material from its owner, the per diem shall cease from the date the necessary material is ordered from the owner until the date when it is received by the road holding the car.

10. Interchange reports shall close at midnight and shall include all cars exchanged upon

the date named unless otherwise noted thereon. The report must be sent to the car record office on each day whether cars are exchanged or not.

In cases where there are different standards of time at junction points the time of the more easterly reckoning shall be used.

The interchange reports to the car record office from junction points must be signed by the agents or other authorized representatives of both roads on the prescribed form, the receipt of cars delivered being thereby acknowledged. Car service rule five (given above) governs the delivery of cars. The time of delivery of cars upon interchange tracks of connecting lines shall, prima facie, be the time given by the delivering road.

11. The junction report for each day will be made to car owners on the prescribed form (C. A. 4) as promptly as possible after the receipt of the interchange report for that day.

12. Within 30 days after the end of each calendar month, car owners shall be furnished with a per diem report for that month, on the prescribed form, showing the number of days each car has been in service upon the road making the report.

13. The settlement of amounts accruing for the use of cars and "reclaims," (rebates) under rule five, shall be made monthly without regard to reclaims pending under rules 13, 14, and 15.

14. When reclaims are made for allowances, under rules 14 and 15, or on account of special conditions they must be made by the designated transportation officer of the road which pays the

per diem to the designated transportation officer of the road from which the allowance is reclaimed.

15. A road failing to receive promptly from a connection cars upon which it has laid no embargo, shall be responsible to the connection for the per diem on cars held for delivery, including the home cars of such connection.

If such failure to receive shall continue for more than three days, the delinquent line shall thereafter in addition be responsible for the per diem on all cars wherever in transit which are thus held back for delivery.

It shall be the duty of a connecting road intending to reclaim such per diem allowance to notify the delinquent line daily of the total number of cars so held for it, and—when required—to furnish the initials and numbers of the cars.

16. When a road gives notice to a connection that for any reason it cannot accept cars in any specified traffic, thereby instituting an embargo, it should receive cars already loaded with such traffic at the time such notice is issued. If it does not receive such cars the road holding them may reclaim per diem from the road placing the embargo for the number of days such cars are held not exceeding the duration of the embargo.

After the date of the notice a road must not load or reconsign cars in such traffic to the road issuing the notice.

All such notices must be given by telegraph, by the embargoing road, to its immediate con-

nection and by it transmitted as may be necessary.

17. These rules do not apply to private cars.

18. To interpret the foregoing rules, and to settle disputes arising under them, an arbitration committee of five members (of the association having the regulation of such matters) shall be appointed by the committee on car service. Three members of the arbitration committee shall be a quorum.

In case any question or dispute arises under these rules, it may be submitted, in abstract, to the arbitration committee through the secretary of the association. The abstract shall briefly set forth the points at issue and each party's interpretation of the rules upon which its claim is based. The arbitration committee shall base its decisions upon the rules and the abstract submitted, and its decision shall be final. Should one of the parties refuse to furnish the necessary information, the arbitration committee shall use its judgment as to whether it can properly decide. All decisions shall be reported to the association through the committee on car service.

In case a question shall arise not covered by the rules, the roads disagreeing may by mutual consent submit such questions to the arbitration committee.

The committee on car service may appoint a Secretary for the arbitration committee who shall be paid by the association. The other expenses of the arbitration committee shall be equally divided between each of the parties to

the dispute and the association. The minimum charge to each road shall be $—, payable in advance. The expenses shall be first paid by the association and then billed (charged) to the parties concerned by the Treasurer of the association.

Analogous to the per diem regulations the following, quoted literally in the main, from promulgated rules and regulations, are in more or less general use among railroads, viz.:

Rates per train mile (charges therefor) for trains using other lines in avoiding washouts or other obstructions, are in effect as follows—for actual mileage used:

Fifty cents per train mile for either a passenger or freight train handled by its own engine and crew; also actual cost of pilotage, fuel, and incidental supplies furnished, plus ten per cent.; also water at rate of fifty cents per tank. In case the engine and crew are furnished by the company whose track is used, the rate is one dollar per train mile, in lieu of all other charges.

The road for which the train is detoured shall also pay the regular per diem and mileage to the owners of the cars in the train—including the road owning the track, if any of its cars are in the detoured train. The mileage charge shall be based on the actual distance over the detoured route.

The following are the rates for use of passenger equipment:

The rate for coaches, dining cars, chair cars, parlor cars, combined passenger cars and postal cars, is 3 cents per mile for

the actual distance; for baggage, express, mail storage, combined baggage-express, combined baggage-mail, and combined baggage-mail-express cars the rate is 1½ cents per mile for the actual distance. These rates to apply when the owners of the cars participate in the business but not when the cars are hired to other lines.

The per diem rate for coaches, dining cars, chair cars, parlor cars, combined passenger cars and postal cars, hired at other than mileage rates, is five dollars per day; for baggage, express, mail storage, combined baggage-express, combined baggage-mail, and combined baggage-mail-express cars, the rate is three dollars per day.

NOTE.—These rates are merely illustrative, it will be understood, although more or less in general use.

When a per diem rate is charged for the use of passenger equipment, as provided for above, the total number of hours of all cars of the same class is calculated on a basis of twenty-four hours for each day and the charge made accordingly; any fraction of a day over the aggregate number of days of twenty-four hours each is counted as one day—it being understood that the minimum charge is one day for each car.

When necessary to haul cars empty over the roads owning them, or intermediate roads for delivery to the borrowing roads (by borrowing roads is meant the roads that have made a requisition for the cars) the tariff rate for such cars is charged the borrowing roads for hauling the cars from the points where they left service to the points of connection with the borrowing roads and return.

NOTE.—The charge that shall be made for the empty haul is a matter of agreement between the companies interested.

It is also a general rule—more or less observed—that the car service charge for delay in loading or unloading a freight car shall be one

dollar a day after forty-eight hours from the time of delivery of the car for loading or unloading (not including Sundays or legal holidays) except where rates are fixed by Statute or local agreements. Proper notice shall also be made in bills of lading, tariffs and freight bills, notifying shippers and consignees of the charge. Charges for delay of cars shall not be refunded except on the approval of the transportation officer designated by each road. At points where neighborhood agreements are in force, however, such regulations shall prevail as may have been prescribed by the companies interested.

CHAPTER VIII.

Forms Used by Auditor of Car Accounts. List of Same.

In reference to the forms contained herein they are intended rather as illustrative of general needs than to arbitrarily fix their number or specific details. Thus, those recounting the movement of equipment and traffic may be extended to the utmost limit of statistical data, or may be reduced to the minimum, or struck out entirely. It is merely a question of the needs of a railroad company.

And in regard to the particular form that shall be used in collecting or disseminating fundamental information that, too, is not a matter of great consequence but of local habit and preference. It is noticeable, however, in practice that a form in use by one company (and esteemed perfect) may have been greatly improved through the ingenuity and skill of the officers of another company. And it is fortunate that this is so, as one company is thus, finally, able to profit by the better practices of another.

The accompanying forms are like all railway exhibits—the eyes (in a measure) through which those in charge see the operations they are interested in and so better able to supervise and record them. That is the great purpose of such

returns. There is nothing sacred about them. What is desired is that the best should prevail, because the best serves best to secure effective service and economy of clerical work and stationery.

Form No.

C. A. 1. INTERCHANGE SLIP (RECORD) OF CARS DELIVERED BY THE RAILROAD MAKING THE RETURN. "A"

C. A. 2. DAILY INTERCHANGE REPORT OF CARS DELIVERED TO CONNECTING ROAD. "B"

C. A. 3. DAILY INTERCHANGE REPORT OF CARS RECEIVED FROM CONNECTING ROAD. "C"

C. A. 4. REPORT (POSTAL CARD) TO OWNERS OF DELIVERY OF THEIR CARS TO OTHER ROADS. "D"

C. A. 5. CORRECTION REPORT. NOTICE OF ERRORS IN REPORT (FORM C. A. 4. "D") OF DELIVERY OF FOREIGN CARS. "E"

C. A. 6. MISSING RECORD REPORT. OWNER'S REQUEST UPON OTHER COMPANIES FOR MISSING RECORD OF ITS CARS. "F"

C. A. 7. PER DIEM REPORT. MONTHLY REPORT (TO OWNERS OF CARS) OF PER DIEM AND PENALTY CREDITS ACCRUING ACCOUNT OF SUCH CARS. "G"

C. A. 8. MONTHLY SUMMARY OF PER DIEM AND OTHER CREDITS FOR USE OF FREIGHT AND OTHER CARS. "H"

C. A. 9. MONTHLY STATEMENT OF CORRECTIONS AND OMISSIONS IN ACCOUNT RENDERED OF PER DIEM AND OTHER CREDITS. "I"

C. A. 10. PER DIEM RECLAIM STATEMENT. MONTHLY STATEMENT OF RECLAIM (ABATEMENT OF CHARGES CLAIMED) BY COMPANY SWITCHING (AND USING) THE CARS. "J"

Form No.

C. A. 11. LETTER OF ADVICE ACCOMPANYING RECLAIM (FORM C. A. 10 "J") STATEMENT. "K"

C. A. 12. PENALTY NOTICE. OWNER'S NOTICE TO CONNECTING ROAD OF PENALTY TO BE CHARGED FOR FAILURE TO RETURN ITS CARS. "L"

C. A. 13. .....

C. A. 14. STATEMENT SHOWING THE TOTAL TONNAGE CAPACITY OF FREIGHT CARS IN THE SERVICE ON THE LAST DAY OF THE MONTH, AS COMPARED WITH THE PREVIOUS MONTH: THE NUMBER OF CARS AND THE TONNAGE CAPACITY THEREOF RETIRED AND REPLACED DURING THE MONTH AND THE NUMBER OF CARS DESTROYED TO BE REBUILT.

C. A. 15. COMPARATIVE (MONTHLY) STATEMENT OF PASSENGER AND FREIGHT TRAIN AND CAR MOVEMENT.

C. A. 16. STATEMENT TO OWNER OF THE NUMBER OF MILES RUN BY ITS PASSENGER EQUIPMENT ON THE LINE OF A FOREIGN ROAD.

C. A. 17. DIVISION SUPERINTENDENT'S ADVICE OF TRAINS MOVED.

C. A. 18. CONDUCTOR'S REPORT OF FREIGHT TRAIN.

C. A. 19. THE LOCAL FREIGHT CAR RECORD.

C. A. 20. FOREIGN FREIGHT CAR RECORD.

C. A. 21. RECORD OF SWITCHING RECLAIMS.

C. A. 22. NOTICE TO PAYING OFFICER OF AMOUNT OF PER DIEM AND CAR MILEAGE CHARGES DUE OTHER ROADS.

C. A. 23. MONTHLY STATEMENT OF FREIGHT TRAIN SERVICE AND MILEAGE OF FREIGHT CARS.

C. A. 24. MONTHLY STATEMENT OF PASSENGER TRAIN SERVICE AND MILEAGE OF PASSENGER TRAIN CARS.

C. A. L. (A.

INTERCHANGE SLIP (RECORD) OF CARS DELIVERED.

This form is used only at terminals where the interchange of equipment is large; in other cases form C. A. 2 suffices. Receipts are given from hour to hour as engineers deliver cars to the receiving road. The use of these slips enables each company to make up its daily interchange reports to the auditor car accounts, on forms C. A. 2 and C. A. 3 given elsewhere herein.

The use of this slip is emphasized more particularly at interchange points where the representatives of connecting lines are not in immediate touch with each other.

C. A. 1. ("A")

INTERCHANGE SLIP (RECORD) OF CARS DELIVERED BY

_____ R. R.

To _____ R. .

At _____ M. Engine No. _____

(Give hour, A. M. or P. M.)

(Name of employe in charge of delivery.)

_____ Station

_____ 19____

X Loaded. — Empty.

This form and a carbon copy thereof is to be filled up for each "cut" of cars delivered to a connecting road. (By "Cut" is meant cars taken from one freight yard to another by an engine without a train conductor.) Deliveries to different lines must not be included on the same slip. This form is to be filled up and a copy made before leaving the yards of this Company. It must be signed by the proper representative, leaving vacant the time of delivery, which will be filled in on reaching the delivery tracks of the connecting road. The signatures of the representative authorized to sign for that road must be obtained. One copy of this slip will be left with the connecting road and the other returned to the agent of the delivering road.

This report should show whether cars are loaded or Empty, X being used for loaded and — for empty cars.

These slips must be preserved for production as evidence if accuracy should be subsequently disputed.

INITIALS	KIND OF CAR	NUMBER	X —	CHECK
				1
				2
				3
				4
				5
				6
				7
				8
				9
				10
				11
				12
				13
				14
				15
				16
				17
				18
				19
				20
				21
				22
				23
				24
				25

Certified correct:

_____ R. _____

Certified correct:

_____ R. _____

Cars "Delivered" C. A. [B]
Cars "Received" C. A. [C]

Report of Interchange of Freight Cars "Delivered" to Other Lines.

This form is filled up in triplicate. It is used by agents at Junction stations for reporting both home and foreign cars delivered to a connecting road.

The agent of the delivering road should sign both the original and copies and send same to the agent of the receiving road for his signature. This report is used by the Auditor of Car Accounts in entering the movements of cars in the car record, and also for checking the per diem accounts. The agent should send the original of this report to the Auditor of Car Accounts and a (carbon) copy to the Car Service Agent, retaining the second copy for his own use.

Report of Interchange of Freight Cars "Received" from Other Lines.

This is a report for "Cars Received" and is precisely like that described above, except that it reads cars "Received from" connecting roads. The rules governing its use are of the same general tenor as those prescribed for cars delivered connecting roads.

These forms are the ones used in recording and distributing cars by the Car Service Agent. See Form C. S. 4. The original reports in question are used by the Car Service Agent, and the duplicates by the Auditor of Car Accounts in his work.

C. A. 2. "B"

REPORT OF INTERCHANGE OF FREIGHT CARS WITH OTHER LINES.

Station, No._____

DAILY INTERCHANGE REPORT OF CARS DELIVERED TO_____R_____

X Loaded.
— Empty. From_____M., to_____M.,_____19__

INITIALS 1	Kind of Cars. 2	NUMBER 3	X 4	Check	POINT OF SHIPMENT 5	FINAL DESTINATION 6	CONTENTS 7	Hour Delivered 8
				1				
				2				
				3				
				4				
				5				
				6				
				7				
				8				
				9				
				10				
				11				
				12				
				13				
				14				
				15				
				16				
				17				
				18				
				19				
				20				
				21				
				22				
				23				
				24				
				25				
				26				
				27				
				28				
				29				
				30				
				31				
				32				
				33				
				34				
				35				
				36				
				37				
				38				
				39				
				40				
				41				
				42				
				43				
				44				
				45				
				46				
				47				
				48				
				49				
				50				

I certify that these cars were received as above.

_____Agent_____R_____

_____Agent.

C. A. 4 ("D")

JUNCTION REPORT OF CARS DELIVERED TO CONNECTING ROAD.

This form is used in reporting to owners the delivery of their cars to another road—i. e., when one company delivers to another company the cars of still another company. It is printed on a postal card or card of the same size.

The auditor of car accounts receives from junction agents reports of all cars delivered to connecting roads—see report form C. A. 2—. Afterwards he advises the owners of the cars (on this form C. A. 4) of the name of the road to which any of their cars may have been delivered.

C. A. 4 ("D")

REPORT (POSTAL CARD) TO OWNERS OF DELIVERY OF THEIR CARS TO OTHER ROADS.

JUNCTION REPORT OF CARS DELIVERED TO CONNECTING ROAD.

On.....19.....

(Printed signature)

(Title of officer)

(Address)

X Loaded. — Empty.

CAR		X	DELIVERED TO
Full Initials	Number	—	(Full Initials)

C. A 5 ("E")

CORRECTION REPORT—NOTICE OF ERRORS IN REPORT (FORM C. A. 4) OF DELIVERY OF FOREIGN CARS.

This form is used by the company owning the car for the purpose of securing correction of error or omission in junction report, form C. A. 4. If the company owning the car discovers in writing up its car records that an error has been made by the road reporting the delivery of the car to a connection, it secures an explanation—and correction—by the use of this blank.

C. A. 5 ("E ")

CORRECTION REPORT. NOTICE OF ERRORS IN REPORT (FORM C. A. 4.) OF DELIVERY OF FOREIGN CARS.

(Address and Date.) 19

Mr.

The following cars embraced in your junction report do not agree with our records. Please advise us of the facts in the case.

(Signature.)

Title of Officer.

Initials	Car Number	Delivered to	Date	Reply

C. A. 6 ("F.")

MISSING RECORD REPORT. OWNER'S REQUEST UPON OTHER COMPANIES FOR MISSING RECORD OF ITS CARS.

(Address and Date) 19 .

Mr. _____

_____

_____

The cars described below delivered your line show later movements but we have no junction report showing delivery to your connections. Please supply the missing record and return sheet to me.

(Signature) _____

(Title of Officer) _____

INITIALS	NUMBER	DEL. YOUR LINE		MISSING RECORD		NEXT REPORT		
		BY	DATE	DELIVERED TO	DATE	DELIVERED BY	TO	DATE

NOTE.—This form, as explained, is used by the owner of cars to obtain necessary information from foreign companies. Thus, if a company in possession of a car should fail to show its delivery to a connecting road, or in fact should fail to show the proper disposition of the car, this blank is used to obtain information necessary to correct the omission. The correction should be made on this form by the company in error, after which it should be returned to the sender.

C. A. 7. ("G")

PER DIEM REPORT. MONTHLY REPORT (TO OWNERS OF CARS) OF PER DIEM AND PENALTY CREDITS ACCRUING ACCOUNT OF SUCH CARS.

Cars of_____R____ Month of_____19____

NOTE.—This form is used by the auditor of car accounts to report the per diem and penalties (credits, etc.) to the company owning the cars.

CAR		DAYS		CAR		DAYS		CAR		DAYS	
INITIALS	NUMBER	Per diem	Pen.	INITIALS	NUMBER	Per diem	Pen.	Initials	NUMBER	Per diem	Pen.
								Col. 1 Col. 2			
TOTAL				TOTAL				TOT. OF SHEET			

Per Diem_____days at___cents per day, $_____

Penalty_____days at___cents per day, $_____ } Total, $_____

(Address and Date.) 19____

(Signature.)

(Title of Officer.)

C. A. 8 (M)

MONTHLY SUMMARY OF PER DIEM AND OTHER CREDITS FOR USE OF FREIGHT AND OTHER CARS.

For cars of _____ R___., Month of _____ 19__

NOTE.—This form is used by the company using the cars to report to the owners the total amount due them when the number of cars requires the use of more than one sheet of form C. A. 7. This form is, however, used in all cases where there is a credit for baggage, passenger, or other than freight cars, as summarized at the bottom.

Sheet	DAYS		PER DIEM SUMMARY			AMOUNT
	Per diem	Penalty				
			Per diem		Days @ — c.	
			Penalty		Days @ — c.	
			RECLAIMS			
			Your Ref. No.	Our Ref. No.	Amount	
					TOTAL RECLAIMS	
					TOTAL PER DIEM	
			MILEAGE		AMOUNT	
			Baggage Cars	Miles @ — c.		
			Passenger Cars	@ — c.		
			Cars	@		
					TOTAL MILEAGE	
TOTAL					GRAND TOTAL	

(Address and Date) _____ 19__

(Signature)

(Title of Officer)

C. A. 9 ("I").

MONTHLY STATEMENT OF CORRECTIONS AND OMISSIONS IN ACCOUNT RENDERED OF PER DIEM AND OTHER CREDITS.

Of_____ R._____ for_____

R._____ Cars for month of_____ 19____

NOTE.—This form is used by the owner of cars to correct errors in account rendered of per diem and other credits by the company using the cars.

CARS		DELIVERED TO (Line or Yard)			DELIVERED BY (Line or Car)			PER DIEM OR PENALTY			REMARKS
INITIALS	NUMBER	BY	Date	DAYS HELD BY	TO	Date	DAYS HELD BY	DUE	ALLD	DISALLD BY	

(Signature)

(Title of Officer)

(Address and Date) 19____

C. A. 10-(7)

PER DIEM RECLAIM STATEMENT—MONTHLY STATEMENT OF RECLAIM (ABATEMENT OF CHARGES CLAIMED) BY COMPANY SWITCHING (AND USING) THE CARS.

This form is used by the company that switches (uses) the cars, for the purpose of making a claim for an abatement of the arbitrary amount that has been charged for the use of the cars switched. This reclaim (or rebate) is demanded of the company for which the service was performed.

The junction agent of the road performing the switching renders this report in triplicate to the agent of the connecting road. Both agents sign the report. The original is sent to the Auditor of Car Accounts of the switching road; a copy is given to the agent of the road for which the switching was performed and a copy is retained by the agent of the road doing the switching.

A provision in the agreement between many companies in reference to per diem and penalty charges provides that "An arbitrary amount for each car in switching service may be reclaimed by the switching line from the road for which the service was performed. This amount shall be based upon the average number of days actually required, and determined by the roads directly interested for each local territory." To facilitate this all agents, where arbitrary time is allowed in switching service, must compile statement immediately after the close of each calendar month, showing the cars switched for other railroad companies. This statement must show both terminal and interline switching, and a separate statement must be made against each belt line or railroad. The statement must be submitted to the connecting line agents for verification and signature, as described above.

PER DIEM RECLAIM STATEMENT. (C. A. 10 "J.")

Statement of Cars Switched by_____Railroad, for_____R_____

at_____ Station, Month of_____19____

Check	Date Rcvd	INITIALS	NUMBER	CONTENTS	Days Arby. Time	Check	Date Rcvd	INITIALS	NUMBER	CONTENTS	Days Arby. Time
1						51					
2						52					
3						53					
4						54					
5						55					
6						56					
7						57					
8						58					
9						59					
10						60					
11						61					
12						62					
13						63					
14						64					
15						65					
16						66					
17						67					
18						68					
19						69					
20						70					
21						71					
22						72					
23						73					
24						74					
25						75					
26						76					
27						77					
28						78					
29						79					
30						80					
31						81					
32						82					
33						83					
34						84					
35						85					
36						86					
37						87					
38						88					
39						89					
40						90					
41						91					
42						92					
43						93					
44						94					
45						95					
46						96					
47						97					
48						98					
49						99					
50						100					
	TOT.										

Correct:_____ **Correct:**_____

(Agent of Switching Company.)

Agent_____**R**_____

A provision in the agreement between many companies in reference to per diem and penalty charges provides that—"An arbitrary amount for each car in switching service may be reclaimed by the switching line from the road for which the service was performed. This amount shall be based upon the average number of days actually required, and determined by the roads directly interested for each local territory."

To facilitate this all agents where arbitrary time is allowed in switching service must compile statement immediately after the close of each calendar month, showing the cars switched for other railroad companies. This statement must show both terminal and interline switching, and separate statement must be made against each belt line or railroad. The statement must be submitted to the connecting line agents for verification and signature as described above.

C. A. 11 ("K")

LETTER OF ADVICE ACCOMPANYING RECLAIM (FORM C. A. 10) STATEMENT.

File No._____

_____ 19__

_____

_____ R_____

_____

Dear Sir:—

Herewith please find reclaim statement (*i. e.*, amount of rebate claimed,) in detail for month of_____ 19__ showing cars handled in switching service for your account, at_____ station, amounting to $_____.

Please include this amount in your next per diem report to this Company, quoting file number given above, or return this to the undersigned with statement of your objections.

Please acknowledge receipt on form attached.

(Signature)

_____

(Title of officer)

_____

_____

To_____

_____

_____

Dear Sir:

Your reclaim statement for month of_____ 19__ (File No._____) showing cars handled in switching service for our account at_____ station, amounting to $_____, has been received. This amount will be included in our per diem report to you for the month of_____ 19__

Yours truly,

_____

_____ R_____

(Address and date)

_____ 19__

NOTE.—This letter of advice accompanies the reclaim statement, form C. A. 10.

C. A. 12 ("L").

PENALTY NOTICE. OWNER'S NOTICE TO CONNECTING ROAD OF PENALTY TO BE CHARGED FOR FAILURE TO RETURN ITS CARS.

_____ 19____

Mr._____

_____

_____

The cars of this company, enumerated below, have been on your line_____consecutive days and you are hereby notified that unless same are disposed of within _____days from this date, a penalty of_____cents per car per day, in addition to the regular per diem rate, will be charged for such cars. Please retain the original of this and return the copy.

_____

_____

CHECK	CAR			DELIVERED		REPLY		
	INITIALS	KIND	NUMBER	BY OR AT	DATE	LOCATION	DISPOSITION	DATE
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								
34								
35								

This notice must be printed in bright red ink. (Such are the specific regulations.) It must be mailed in duplicate. The original will be retained by the receiving road and the duplicate returned as an acknowledgment, and bearing notations showing disposition made of cars which may have cleared the line of the receiving road. No form of penalty notice must be used, differing in size or style from this. This notice must be mailed in an envelope bearing the full and complete address (name, title, road, town and state) of the officer to whom sent. Preferably it should be sent by U. S. mail only, although in the case of immediate and direct connections, it may be forwarded by railway service.

PENALIZING A COMPANY. In order to penalize a company having cars in its possession (i. e., enforce a penalty for the detention of cars), the owner must demand the return of his car after it has been a stipulated number of days (say twenty) consecutively, on a road. If the car is held by such road more than a given number of days (say ten) after the date of such demand (given on the prescribed form) the penalty charge agreed upon for each day of detention thereafter, is enforced in addition to the usual per diem rate.

C. A. 14.

STATEMENT SHOWING THE TOTAL TONNAGE CAPACITY OF FREIGHT CARS IN THE SERVICE ON THE LAST DAY OF THE MONTH AS COMPARED WITH THE PREVIOUS MONTH. THE NUMBER OF CARS AND THE TONNAGE CAPACITY THEREOF RETIRED AND REPLACED DURING THE MONTH AND THE NUMBER OF CARS DESTROYED TO BE REBUILT.

This blank is used to report to the proper official the total ton capacity of cars in the service at the close of each month as compared with the previous month; also the number and ton capacity of cars retired and number and ton capacity of cars replaced during the month, and the number of cars destroyed which are to be rebuilt.

This information enables the official in question to determine the exact number of cars available for service and their carrying capacity, and to what extent the carrying capacity of the road has been increased or decreased during the month.

C. A. 14.

STATEMENT SHOWING THE TOTAL TONNAGE CAPACITY OF FREIGHT CARS IN THE SERVICE ON THE LAST DAY OF THE MONTH AS COMPARED WITH THE PREVIOUS MONTH. THE NUMBER OF CARS AND THE TONNAGE CAPACITY THEREOF RETIRED AND REPLACED DURING THE MONTH AND THE NUMBER OF CARS DESTROYED TO BE REBUILT.

Month of_____ 19___

Kind of cars	Comparative tonnage capacity in service							
	_____ 19___				_____ 19___			
Box								
Stock								
Flat								
Gondola								
Iron Ore								
Ballast								
Total								
Increase-Decrease								

Number of cars retired and replaced

Kind of cars	No. of cars retired	Tons retired	No. of cars replaced	Tons replaced
Box				
Stock				
Flat				
Gondola				
Iron Ore				
Ballast				
Total				

Number of cars destroyed to be rebuilt.

Box cars	
Furniture "	
Refrigerator "	
Stock "	
Flat "	
Gondola "	
Iron Ore "	
Ballast "	
Total	

To_____

_____

_____

Auditor Car Accounts,
[Or whoever keeps the records.]

COMPARATIVE STATEMENT OF PASSENGER AND FREIGHT TRAIN AND CAR MOVEMENT.

For the month of_____19___

PASSENGER	YEAR 19....	YEAR 19....	PERCENTAGE Increase	PERCENTAGE Decrease
Total number of trains run,				
Average number of trains run per day,				
Total number of miles run by trains,				
Average number of miles run by each train,				
Total number of miles run by passenger, baggage, mail and express cars,				
Number of passenger cars hauled,				
Number of baggage, mail and express cars hauled,				
Total number of cars hauled,				
Average number of passenger, baggage, mail and express cars hauled in each train				
FREIGHT				
Number of trains run,				
Average number of trains run per day,				
Total number of miles run by trains,				
Average number of miles run by each train,				
Total number of miles run by loaded cars,				
Total number of miles run by empty cars,				
Total number of miles run by all cars,				
Number of loaded cars hauled west bound,				
Number of empty cars hauled west bound,				
Number of loaded cars hauled east bound,				
Number of empty cars hauled east bound,				
Total number of loaded cars hauled,				
Total number of empty cars hauled,				
Total number of cars hauled,				
Average number of cars hauled in each train per mile run				

MILEAGE OF LOADED FREIGHT CARS.

(NOTE:—Like space should be provided in the statement for empty cars, if desirable to show them apart from loaded cars.)

DIVISION	WEST BOUND				EAST BOUND			
	19...	19....	Percentage		19....	19....	Percentage	
			Inc.	Dec.			Inc.	Dec.
Total Loaded Mileage								
Total Empty Mileage								

Loaded car mileage must be entered in black ink.
Empty car mileage must be entered in red ink.
Mileage of caboose and construction cars excluded.
Mileage of ore cars included.

	19....	19....
Percentage of loaded car mileage to total loaded and empty car mileage hauled . .	.....	.....
Percentage of empty car mileage to total loaded and empty car mileage hauled . .	.....	.....

Mr. _____

_____ 19____

Auditor Car Accounts.

NOTE:—On this form is rendered a monthly comparative statement of the performance of passenger and freight trains and cars. It is compiled from the conductors' report of train, Form C. A. 18. It embraces information in regard to the number of trains run, average number of miles run by each train, number of cars hauled west and east bound, mileage of loaded and empty cars, etc., etc. This information assists the operating officials in determining whether trains and cars are being used effectively, and what the percentage of increase or decrease is for the month or year, as the case may be. The information afforded by this blank—like all similar exhibits—it is apparent, may be greatly elaborated; and so the value of the form (to the student) is largely illustrative.

C. A. R.

STATEMENT TO OWNER OF THE NUMBER OF MILES RUN BY ITS PASSENGER EQUIPMENT ON THE LINE OF A FOREIGN ROAD.

OFFICE OF AUDITOR CAR ACCOUNTS.

To _____

Dear Sir: Herewith please find report of mileage of _____ railroad passenger cars on _____ Railway during the month of _____ 19__

Auditor Car Accounts

KIND OF CAR																
NUMBER																
DATE	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles
1																
2																
3																
4																
5																
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30																
31																

NOTE:—This form is used in notifying owners of passenger cars of the number of miles run by each individual car while on the line of another road. This information is required because the terms of purchase of passenger car wheels and the guarantee thereof, is in many cases based upon the number of miles run, and in no way, save this, can such information be obtained while cars are on other roads.

C. A. 17.

DIVISION SUPERINTENDENT'S ADVICE OF TRAINS MOVED.

To the Auditor, Car Accounts.
To the Ticket Auditor.

Office of Superintendent.
_____ Division.
Office at _____ Date _____ 19___

Dear Sir:
Below find list of trains moved on this Division on _____ 19___

_____ Division Sup't.

No. of Train.	Name of Conductor in Charge.	Where Train Was Taken From.	Where Train Was Left.

Note.—This is a form on which the division superintendent reports to the auditor of car accounts a list of trains moved on his division each day. It is used to determine if conductors' reports of trains have been received for every train run on the division.

It is made in duplicate, one copy being forwarded to the ticket auditor by whom it is used in checking conductors' ticket returns and cash fare reports.

C. A. 18

Conductor's Report of Freight Train.

This blank is the same as C. S. 3.

It is used by freight train conductors in reporting freight cars hauled in their trains. It is made in duplicate, one copy going to the auditor of car accounts, and the other to the car service agent for his use. From this report is written up the local freight car record and foreign freight car record, forms C. A. 19 and C. A. 20.

The conductor's report of freight trains is used by the auditor of car accounts in verifying the accuracy of the division superintendent's report of trians moved—Form C. A. 17. It is, moreover, the source from which information is derived of car, train, and tonnage statistics.

CONDUCTOR'S REPORT OF FREIGHT TRAIN.

FREIGHT CONDUCTOR'S TRIP REPORT. *Train No.*_____ *Date*_____ *19*____

*Ordered to leave at*_____ *M. Left*_____ *at*_____ *M. Arrived at*_____ *Station at*_____ *M*

*Conductor*_____ *Brakeman*_____

	CLAIMED.		ALLOWED	
	Through	Way-Freight	Through	Way-Freight
Scheduled Mileage, - - - -				
Overtime, - - - - - - -				
Delayed Time, - - - - -				
Switching at Terminals, - -				
Total Mileage for Day's Work,				

*Miles run*_____

REMARKS.

The numbers and initials of cars must be taken from the cars and not from way-bills.

	INITIALS	CAR NUMBERS		OFFICE CHECK COLUMN	BILLED FROM	BILLED TO	WHERE TAKEN	WHERE LEFT	CONTENTS	CAR MILE-AGE	Weight of car & contents in tons	This column is to be left blank.
		Loaded	Empty									TON MILES.
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

C. A. 19.

The Local Freight Car Record.

This record is the same as C. S. 1.

It is used by a railway for the purpose of recording the movements of its freight cars on its own (home) line; also the movements of its freight cars on other (foreign) roads.

The record is written up in the first place in the office of the car service agent and is used by him in the distribution of cars.

It is afterwards used—to save duplication of records—by the auditor of car accounts in compiling mileage statistics and in verifying the accuracy of per diem statements received from other roads.

LOCAL FREIGHT CAR RECORD. C. A. 19.

(¼ of the page.)

Movements of Cars from _____ 19___ to _____, _____ 19___

(Illustration: Cars Nos. 7100 to 7198.)

Last Record brought forward	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
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02																																02
04																																04
06																																06
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48																																48
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	

C. A. 20

Foreign Freight Car Record.

This is the same as the Car Service Agent's return Form C. S. 2.

The record is used by a company to record the movements of foreign cars in its possession. It is written up originally in the office of the car service agent, and is used afterwards by the auditor of car accounts—to save duplication of records—in compiling statistics and in accounting to other roads for the use of their cars.

C. A. 20.

FOREIGN FREIGHT CAR RECORD.

Record of Movements of _____ _____ R. R. freight cars during month of _____ 19___

| Cars Received | | | | | | Last Record Brought Forw. | | | | | |

RECORD OF SWITCHING RECLAIMS.

For the month of _____ 19____

NAME OF ROAD AND JUNCTION.	Amounts PAID to foreign roads.	Month in which the reclaim was allowed.	Amounts RECEIVED from foreign roads.	Month in which the reclaim was allowed	REMARKS.
Railroad					
Junction					
Railroad					
Junction					
Railroad					
Junction					
Railroad					
Junction					
Total.....					

NOTE.—This form is used for the purpose of keeping a record of amounts paid to and amounts received from other roads on account of switching reclaims under the per diem rules. It shows the road and junction of interchange and the month in which settlement is made. When business is interchanged at more than one junction the total should be entered in the space provided therefor.

C. A. 22.

NOTICE TO PAYING OFFICER OF AMOUNT OF PER DIEM AND CAR MILEAGE CHARGES DUE OTHER ROADS.

OFFICE OF AUDITOR CAR ACCOUNTS.

No._____ _____ 19____

Statement of amounts due from the company specified below on account of per diem and car mileage, the same to be reported and taken up — by me in the return for month of_____ 19____

Auditor Car Accounts.

NAME OF ROAD.	MONTH.	AMOUNT.

NOTE.—This is the auditor of car account's notice to the treasurer or accounting officer of a company of amounts due from other companies for the month on account of per diem car mileage, etc. As soon as a return is received by the auditor of car accounts from a company specifying the amount due from it, the amount is at once certified to the proper officer by the auditor of car accounts (on this blank) so that the balance for the month may be struck and the payment thereof arranged. In the plan of settlement, of which this is a part, there is no delay, it being the practice for the company in whose favor there is a balance to draw for same at sight, without notice. This is done as soon as the reports for the month, between the companies interested, have been exchanged.

C. A. 22.

Monthly Statement of Freight Train Service and Mileage of Freight Cars.

A monthly statement is rendered on this form to officials interested in the movement of equipment. It gives the number of loaded home cars moved westbound during the month, and number of miles hauled, also the number of loaded foreign cars moved westbound and their mileage, by divisions. It also gives the same information in regard to empty home and foreign cars westbound—the total of both loaded and empty westbound cars being carried out by divisions. Similar spaces are provided in the blank for loaded and empty home and foreign cars eastbound. The blank further provides for columns in which are entered the number of freight trains west and eastbound; total number of miles run by freight trains; number of cars hauled in construction trains and their mileage; total number of freight cars hauled; the average number of cars hauled in freight trains; number of miles run by freight and passenger trains, and the number of miles run by empty freight engines west and east bound.

This blank, like all these relating to movement of equipment, it is apparent, may be enlarged or reduced as the requirements of particular companies suggest.

_____ Railway. C. A. 23.

OFFICE OF AUDITOR CAR ACCOUNTS.

MONTHLY STATEMENT OF FREIGHT TRAIN SERVICE AND MILEAGE OF FREIGHT CARS.

For the month of _____ 19___

Division.	Loaded Cars, Westbound						Total (Loaded and Empty) Westbound			
	(Home) Road		Foreign		TOTAL		(Home) Road		Foreign	
	No. Cars	Miles	No. Cars	Miles	No. Cars	Miles	No. Cars	Miles	No. Cars	Miles
Total										

(A similar section is provided for loaded cars eastbound: Also for empty cars westbound, and for empty cars eastbound.)

Division.	Number of Freight Trains		Total Number Miles Run by Freight Trains	Construction Trains Run		Total Number Miles Run by Freight Cars (West and East)	Total Number Freight Cars Hauled	Average No. Freight Cars Hauled in Train	Total No. Miles Run by Freight and Passenger Trains	Number Miles Run by Empty Freight Engines	
	West	East		No. Cars	Miles					West	East

Average number of cars hauled in freight train, _____

Average miles run by each train, _____

The average number of cars hauled in freight trains is found by dividing total freight car mileage by total freight train mileage. The average miles run by each freight train is found by dividing total freight train mileage by number of freight trains run. The mileage of caboose cars is eliminated.

_____

Auditor Car Accounts.

C. A. &

Monthly Statement of Passenger Train Service and Mileage of Passenger Train Cars.

This blank is used in rendering a monthly statement to officials interested in the movement of equipment, of the number of passenger, sleeping, baggage and mail cars hauled during the month, and the mileage thereof. It is so arranged that the number and mileage of westbound passenger, sleeping, baggage and mail cars, home and foreign, are shown separately by divisions; totals for passenger cars, westbound, and their mileage is also given. In the form as used similar sections are provided for eastbound cars.

In addition to the above it is also arranged to show, by divisions, the number of passenger trains run east and west; the total number of miles run by passenger trains; total number of miles run by passenger cars; total number of passenger cars hauled; average number of cars hauled in passenger trains, and the number of miles run by empty passenger engines west and east bound.

This exhibit like all those contained herein relating to the movement of equipment, traffic, etc., may be enlarged or reduced according to the requirements of those using them. They are merely illustrative therefore.

_____Railway. C. A. 24.

OFFICE OF AUDITOR CAR ACCOUNTS.

MONTHLY STATEMENT OF PASSENGER TRAIN SERVICE AND MILEAGE OF PASSENGER TRAIN CARS.

For the month of_____19____

DIVISION	PASSENGER AND SLEEPING CARS, WESTBOUND						BAGGAGE AND MAIL CARS, WESTBOUND						Grand Total, Westb'd	
	(Home) Road		Foreign		Total		(Home) Road		Foreign		Total			
	No. Cars	Miles	No. Cars	Miles	No. Cars	Miles	No. Cars	Miles	No. Cars	Miles	No. Cars	Miles	No. Cars	Miles
TOTAL														

(Similar space is provided for passenger equipment eastbound.)

DIVISION	NUMBER OF PASSENGER TRAINS		Total Number Miles Run by Passenger Trains	Total Number Miles Run by Passenger Cars	Total Number Passenger Cars Hauled	Average Number Cars Hauled in Passenger Trains	EMPTY PASSENGER ENGINE MILEAGE	
	Westbound	Eastbound					Westbound	Eastbound
TOTAL								

Average number of cars hauled in passenger train_____

Average miles run by each train_____

The average number of cars hauled in passenger train is found by dividing total passenger car mileage by total passenger train mileage.

The average miles run by each passenger train is found by dividing total passenger train mileage by number passenger trains run.

_____

Auditor Car Accounts.

CHAPTER IX.

Care and Maintenance of Cars.

Fully seventy per cent of the total cost of railway equipment is for cars. Afterwards their care and maintenance, including cost of operating and maintaining shops, machinery, tools, necessary tracks, superintendence, etc., approximates eight per cent of the gross cost of operating a railroad.

These enormous expenditures are carried on under the advice and direction of the Superintendent of the Car Department. And it is found that the more often his advice is sought and the greater heed paid to it, the greater the benefit that will accrue to the railroad company. The earlier in the operation of a railroad that a capable Superintendent of Cars is appointed and asked to locate and map out car shops and grounds, and the tracks incident thereto, the better it will be for the company afterwards.

The location of shops and the provisions in connection therewith on new lines are, too often, the last things thought of in connection with the construction work. And it is a common thing on well managed railroads to see local round-houses and car and engine repair shops erected without any provision being made

for the storage and care of material, tools, and things of that kind. This is because co-operative advice is not sought; somebody who only knows (or thinks of) part of what is needed, thoughtlessly takes the responsibility of deciding for all!

In the planning and building of a railroad, (unless it be an extension of an old system or the work is supervised by veterans in railway operations) little thought is given to anything except the main line and sidings. Somebody, it is quite likely, who perhaps knows very little about the needs of equipment, will say, with a look that silences everyone within hearing, "Well, let us put aside thirty acres at such and such a place for shops," when, very likely one hundred acres or more could be used to advantage. Thus the superintendent of the car department and the superintendent of motive power and machinery are never afterwards able to work effectively; and, because of this handicap the maintenance of equipment is carried on at a disadvantage and at increased cost for all time —and this because the advice of experts, (in the company's employ and under pay) was not sought at the proper time or proper deference paid to their superior judgment and experience.

The planning of passenger cars passed with the advent of Pullman, from the hands of mechanics to those of skilful designers, artists and high class decorators. Freight car construction, on the other hand, still looks wholly to strength

and practical utility. Nevertheless these homely vehicles have improved somewhat in beauty of outline as well as in strength and carrying capacity. Car construction is still carried on to a certain extent by railway companies, but more commonly than otherwise they devote their energies in this direction to maintaining the cars they buy in the open market; and it is in reference to the maintenance of cars, including their care and working, that this chapter treats.

Responsibility for this service rests upon the official known as the Superintendent of the Car Department.* His duties are of an executive character and embrace responsibilities requiring in their exercise extended practical experience and administrative qualities of the highest order.

His opportunities to further the interests of his company are, perhaps, greater in degree than any other official having to do with the handling and supervision of cars. The field he superintends is great and the wear and tear and unavoidable destruction of property from accidents and otherwise, constant. It is his particular duty to see that these losses are minimized and that the car equipment is maintained at the maximum of efficiency with the least possible cost.

If all of the cars that belonged to a railroad passed daily under the eye of the superintendent, his immediate knowledge of their needs in the way of maintenance and betterments would greatly simplify the situation. But as a matter of fact the cars subject to his guardianship and

*The old title—still used sometimes—was Master Car Builder.

care, number many thousands and are scattered over the whole country—for he must not only look after the cars on the home line but those also in use by connecting roads. How is he to keep himself advised? How act, when he does not see the cars and is ignorant of their location and condition except, indeed, the few that pass into or out of the shops and yards under his immediate eye? Manifestly, in order to be familiar with these details; to know where the cars are, whether they fulfill requirements or not, what their condition is, and the repairs that are necessary, he must depend on the returns—verbal and written—that he receives from his subordinates and others.

With the aid of these he may and does know the condition of every car, and, summing up the whole, of the cars in the aggregate. The trustworthiness of the returns he receives is apparent, for in every case they are based on the personal inspection and knowledge of those in immediate charge. Thus the superintendent and his assistants are kept advised of each kind of car and its condition, and thus advised they are able to maintain them effectively, and doing so meet the just and pressing expectations of the management, and the urgent requirements of the public who use the cars.

These returns are illustrated at length further on, with explanations of their purpose, how compiled, when and by whom made and to whom sent. With the aid of these, those in charge are able to scrutinize each car requiring attention, wher-

ever it may happen to be. Through these returns they know what cars require repairs, what repairs are being made and where, and how many men are engaged in such work, including that of maintaining, cleaning and lighting the cars in actual use. Through these returns the superintendent knows how many cars are available, how many are in the hospital, the nature of their ailment and, finally, when they will be put back into the service; information, in fact, so specific that the forms have but to be studied by those concerned to keep them informed as effectively as if present in person on the ground.

This is one important feature of car supervision in its daily application, and all who would seek to know the practical working and administering of the car department must study these forms—learn them by heart—for no where else can the information they contain be found.

The duties of the superintendent relate also, as an advisory officer, to the procurement of new cars from time to time, as the service requires. And, in connection with such needs, he must be advised by observation, research, and practical experience, concerning the constructive features of cars including all the minor appliances and fixtures relating thereto. For the evolution in construction and adaptation of cars to practical needs—demonstated by experience or evolved by inventive genius—is as constant and as great as in any other field of industry. This does not need illustration; or, if it did, we have but to compare the cars formerly on railways with

those in current use. In every feature there has been advancement, greater strength and, consequently, greater durability; increased utility; greater capacity; greater security; and, in the case of passenger cars, greater safety and comfort. All this, withal, with relatively less cost.

It is, however, in connection with the maintenance of cars that the greatest usefulness of the department lies. The ordering of equipment is of infrequent occurrence and easy of accomplishment. Its maintenance afterwards, however, requires incessant care and watchfulness over a wide field; work that demands in its discharge extended and diversified experience and a high order of talent. The great quantity of material that the maintenance of cars involves, the superintendent and his assistants must personally supervise. This material embraces a vast number of articles of widely different nature and varied utility, but alike necessary in the conduct of business. These requirements involve vast outlays of money, but are lessened greatly, in practical work, through the ingenuity and skill of those in charge by the refuse of scrap and other available parts of abandoned cars. In this way a great saving, scarcely known or appreciated outside of the department, is effected.

Not only must those in charge possess technical skill, but the business acumen that is evinced in the wise foresight that anticipates the wants of the department, and so makes provident use of the present to order the equipment and material that will be needed in the future; and this

without exaggerating actual and imperative requirements. The care exercised not to exceed actual needs as regards supplies ordered for future general use and temporarily stored in the care of the storekeepers of a company, also extends to supplies placed in the hands of foremen for immediate use in and about the shops and repair tracks and sheds. And in regard to these last petty supplies taken from the general store, the same watchfulness is exercised to prevent waste or improper use that is thrown around the general supplies of a company; for neglect here, as elsewhere, invites extravagance, added cost and unsatisfactory results.

Further supervision over the material of the car department is aided by carefully devised reports of material used and on hand, made by foremen and others at the shops and various depots where supplies are kept to meet daily needs.

In this way it will be seen the care and watchfulness continue from the time material is ordered until it is actually used; and, according to the measure of this supervision, it is needless to add, efficiency or the reverse will exist. And when speaking of material, not only articles used in the maintenance of cars is meant, but tools, lubricants, waste and other supplies, including those for lighting and the implements and fixtures incident thereto. Finally, the measure of efficiency exercised in the disbursement and use of material, is scrutinized by the management in the light of returns showing the cost per mile

run by cars, and in such other ways as the ingenuity of those in charge may devise and enforce.

Among the important returns required by the department are those relating to the wear and tear of wheels, the strength and durability of which is a matter of such supreme importance to the safe and economical operation of trains. Through these returns the superintendent and his aids are kept advised of the actual life of every wheel and the work it has performed. In furtherance of this, particulars of all defects are reported and carefully tabulated for future guidance and reference. Records are also kept of all wheels guaranteed by manufacturers to see that the guarantees are fulfilled in practice. Reports are also required of hot boxes and the cause thereof, when delays and accidents result therefrom. Similarly, failures and defects in air-brakes are valuable for the information and guidance of those interested.

Concerning the car proper the superintendent requires reports of all cars damaged and in many cases the cause thereof; particulars of bad order cars on hand and where located; cars worn out and destroyed by his orders; special and general repairs required by cars, including those owned by other companies; cars cleaned; cars repainted; cars rebuilt; cars ready for service; new cars received. Reports, in fact covering every phase of the subject necessary to his enlightenment, and that of the managing officials of the company.

The numbering of cars and the grouping of

the numbers is one of the many duties which falls to the lot of the superintendent. The practices of railroad companies are not, however, uniform in regard to numbering cars. Thus one company will set aside all numbers say from 1 to 1500 for its passenger cars; and all over that number for freight cars. Of the latter series, the even numbers will perhaps be assigned to box, furniture, refrigerator and other enclosed cars; the odd numbers being assigned to other classes of cars. Or a company may set aside the numbers, both odd and even, between 10,000 and 20,000 for one class of cars and between 20,000 and 30,000 for another class, and so on. The purpose, whatever the plan may be, being to enable those interested to determine the kind and class of a car upon hearing the number, so far as any plan can do this without too much elaboration.

The lettering on cars seems a simple and mechanical matter to the idle looker-on, yet it is not so; for the information conveyed and the manner and place of conveying it are, really, matters of careful study and arrangement based on long experience and the needs of the service. On some cars the work is artistic, so far as its nature permits; on others it is the reverse. So, too, in regard to painting cars: the color and kind of paint and the quality of varnish, and the manner in which all are applied, more often than otherwise indicate taste and discernment as well as the practical question of usefulness and wear and tear.

Another duty that belongs to the superintendent of the car department is the preparation and general distribution of the "Object" cards that are nailed to cars showing at a glance those that are in "bad order;" that are "defective;" that need "light repairs;" that need "general repairs;" that are "to be destroyed;" that are "ready for service;" that are loaded with "inflammable material;" that are subject to "penalty" under the rules; "home route" cards, etc. Provision in fact, being made to cover every emergency of the service at the minimum of cost.

Similarly, the oversight of the superintendent and his assistants extends, with minute particularity, to every phase of the work: the maintenance of shops; the procurement and maintenance of machinery and tools; details of repairs to cars; cars rebuilt; articles manufactured for use by the department; piece work; work done for individuals and corporations, and so on. And as the cars of different companies are used in common, it falls to the department to make such repairs as may be necessary to the cars of other roads, and in doing so to discriminate between the repairs that are chargeable against the owner and those that must be made at the expense of the company using them.

The permanent records in the office of the superintendent of cars depend upon the division of the work as regards the handling of material and the keeping of the accounts. Those of a fundamental nature, however, that may be named, irrespective of any such conditions, are:

the record of repairs to different classes of cars, a record of passenger cars; record of freight and other cars; record of oil, waste and tallow used; record of car wheels; record of car mileage; and, finally, material and labor records. The extent of these last named will, however, as already observed, depend upon the organization as regards division of work and responsibility.

It is to the superintendent of cars and those about him, as already intimated, that a company should look for plans for its shops and repair buildings; the tools and machinery the service requires; the tracks and sidings necessary for the purposes of the department, and all the other paraphernalia incident to its operations.

He is at once a constructive and operating official; building up and afterwards maintaining and operating. And to do this he must feel the pulsations of his department however remote or faint. Through observation, personal intercourse, the telegraph, and special and stated returns, he keeps himself actively and in minute contact with every phase of the situation. The information, thus acquired, is imparted by him to such general managing officials of the company as may be interested. And this last is as necessary as the first; for in no other way can he secure their active and intelligent co-operation and advice; things so necessary in corporate life where there is divided responsibility for work done and results achieved.

Not only does the superintendent keep himself in touch with the local conditions and needs

but through attendance at the meetings of superintendents of cars and by personal intercourse with such officers on other roads, keeps his plant and equipment in line with the best constructive and operating practices of the day. And it is due to him and this intercourse, that the uniformity and general usefulness of cars has been obtained.

And it is needless to say that the measure of success the individual superintendent attains in his intercourse with the officials of other companies is dependent upon his industry, experience and tact. It also falls out, in this connection, in the practices of the department, that because of the general understanding among master car builders, the superintendent of the car department has, in a great measure, to supervise and audit the manifold accounts that arise between railroads in connection with the repair and maintenance of the cars used in joint service. And as these accounts are numerous and often complicated and for considerable amounts, the faithful performance of the service requires time and accurate knowledge, and systematic provision.

In conclusion, it may be said, that the great number of men employed by the car department, scattered as they are over a wide territory, involve careful organization and constant watchfulness. In the building up of the force, those employed are selected only after careful scrutiny under forms prescribed by the superintendent. Thus, he controls the force and, through the

returns, keeps himself advised of its work; the number of men at each point; the actual time worked by each man—including regular and overtime—; the kind of work each man is engaged upon, and finally what he accomplishes.

In this way and by carefully devised methods, the result of experience and careful provision, the department is supervised throughout, the superintendent and other responsible officers of the company watching the procurement of cars and, afterwards, their maintenance; the purchasing of material; its use; the hiring and discharging of men; their need and fitness; and so on through all the varied ramifications and multiplied exigencies of the service.

CHAPTER X.

Arrangement of Car Shops and Organization of Forces.

I have described in the preceding chapter, with more or less particularity, the duties and responsibilities of those in charge of the care and maintenance of cars. However, in this case, as in every other of a like nature, it is interesting and instructive above all to hear what the master himself—the man who actually does the thing—has to say on the subject. The great importance and value of such expression has led me to solicit—and happily to secure—this from Mr. Charles A. Schroyer, a superintendent of the car department of one of the great railways of the world; a man of long and widely diversified experience, who has no superior in the service and is everywhere recognized as an eminent and trustworthy authority in this important branch of railway operations.

Having secured this interesting and highly valuable exposition of the subject, I submit it without comment for the benefit and enlightenment of those who seek to know something concerning the administration and interior working of the car department, but whose facilities render the acquiring of such information impossible; information, it may be said, that is of the greatest

value to everyone who seeks railway advancement in this or any of the other fields of preferment. With this brief explanation I submit what Mr. Schroyer so pertinently says on the subject.

The large number of passenger and freight cars, that comprise the rolling stock of a railroad, are of so much importance that the work of maintaining this equipment requires the most careful preparation and supervision.

In the beginning of railroads, and now with new roads, oftentimes little provision is made or thought given to the repair and maintenance of cars; a few outlying tracks and rough sheds being deemed sufficient.

As the car equipment of a railroad increases in number and age, however, the importance of its maintenance becomes more and more pronounced. Permanent shops are then established for performing such work as is required in making what is generally known among car men as "Heavy repairs to freight cars." Shops are erected, machinery installed, and permanent tracks laid in close proximity, where the work of making light and heavy repairs can be carried on at the minimum of cost. Organization for supervising and doing the work also assumes tangible shape. Schemes, such as Transfer-tables (operated by electricity) for handling cars in the yards, places for the storage of cars while awaiting repairs, provision for painting cars, and other necessary facilities are inaugurated.

The organization of the car department, as finally perfected, is generally, as follows:

The Superintendent of the Car Department or Master Car Builder, who has charge of the forces constructing and maintaining car equipment.

Interchange Inspectors. Their duties are to inspect cars under "Master Car Builders'" (M. C. B) rules at interchange points where cars are delivered to and received from foreign companies. They note the general condition of the cars and especially defects for which owners are responsible in contradistinction to defects for which the operating line is responsible; these they write up on the records and specialize in their returns.

General Inspectors. Their duties are to inspect cars at terminal stations, to determine whether or not they are safe for operation and handling freight.

NOTE.—Inspectors of passenger cars at Terminals are classed as General Inspectors.

Local Inspectors. These inspectors are located at important stations along the line and it is their duty to inspect cars while enroute, to determine their safety and to ascertain whether or not defects are such as to necessitate the removal of the car from the train in order to prevent accident or further damage; also to look after the oiling and icing of cars enroute, etc.

General Foreman. His duties are to supervise inspectors and local foremen, in the yard of the principal shop where heavy repairs are made to cars. He also has general charge of such work

and is in fact one of the superintendent's immediate assistants.

Gang Foremen. They have charge of the men actually making repairs to cars.

Freight Car Foremen of the first class. They are employed in the yards where heavy repairs are made, about the principal shop.

Freight Car Foremen of the second class. They are employed in charge of the force at local points where light repairs are made.

Foremen of the third class. They have charge of the force at local points engaged in making running repairs to cars in transit.

Freight Car Carpenters. They are employed in yards where the principal work is performed, and their duties comprise laying out; framing of heavy and other timbers of the car; and the work of constructing new cars. This class of help furnishes its own tools.

Freight Car Repairers. The men who take the lead in the work performed in making heavy repairs to cars.

Freight Car Repairers' Helpers. These men do the secondary work and assist the Car Repairers where heavy repairs are being made.

Car Smiths. Performing the general work of repairs in yards where light and running repairs are made.

Handy Men. Employed at local and terminal stations whose duties comprise oiling, inspecting, cleaning, icing and making light repairs to cars.

Car Oilers: men whose exclusive duties are the oiling of both freight and passenger cars.

Oilers and Inspectors: men whose duties embrace the oiling and inspection of cars while in transit, in terminal yards, and on team tracks, etc.

Foreman's Clerk. His duties are somewhat general but more particularly embrace the keeping of a record of all cars passing over the repair tracks; details of repairs made to same; filling out cards. in accordance with the Master Car Builders' rules for defects existing, for repairs made, for defects for which owners are responsible, and for repairs made for which the operating line is responsible.

The above classification, in a general way, covers the important divisions. A force employed for special purposes is always so indicated on the pay roll and other records of a company.

The location of the car shops should be centralized to the greatest possible extent at such points as will best meet the requirements of the service and avoid, as far as possible, the transporting of bad order cars over the line.

On a railroad having from, say, four to five thousand miles of track, two main shops should be conveniently located at different points on the line, in which there should be facilities for making heavy repairs and getting out the various kinds and classes of materials used in such repairs of cars.*

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*In this case as in all similar cases the provision made should be such as the needs of a company require.

The shops should be generally arranged as follows:

Blacksmith Shop. Such a shop should be especially provided for doing the work of the car department, lest the work should be interrupted by the miscellaneous and varied character of work performed in the locomotive department blacksmith shops. It usually happens that when car department work is left to be done by another department, the work of the latter is too often considered more important and so is given the preference—the car work suffering correspondingly therefrom. It is also of advantage to have a blacksmith shop for the car department for the reason that the work can be done by men of less skill than in the locomotive blacksmith shop because of the large quantities of work of a duplicate character.

The Planing Mill. The planing mill should be so arranged as to enable the work of framing heavy timbers to be done in one part of the mill, and the work of a lighter nature taken care of in another part without being brought in contact with one another.

Cabinet Shop. This shop should be provided with facilities for taking care of the lighter class of work in framing way (caboose) cars, refrigerator cars, and other similar classes of miscellaneous car equipment.

The Foundry. The foundry should be provided with sufficient capacity for the getting out of both brasses and gray iron castings.

Machine Shop. The machine shop work of the

car department can also be done by men of less skill than those ordinarily classed as machinists; and therefore it is economy to have a machine shop for the car department separate from the locomotive machine shop. This shop should be located on tracks having switches at both ends where work of repairs of a heavy nature can be made and where bad order cars can be placed at one end and good order, or repaired cars, can be taken out from the other. A series of tracks should also be placed in close proximity to the shop, on which cars may be placed that are in need of repairs ordinarily classed as "light." A switch should be placed at either end of such tracks, to be used in placing bad order cars at one end and for removing repaired cars at the opposite end. A sufficient number of tracks should be installed in the yard at such places where they will not interfere with the work of the switching department, upon which may be stored cars awaiting repairs, and also those that are to be painted.

A Scrap Yard is necessary where materials removed from cars repaired and from wrecked cars received from the road, can be assorted and disposed of. A well regulated scrap yard is of more value to a railway company than is usually thought, and if it is not properly arranged, the work of handling scrap material is so laborious that often times the amount received from the sale of the scrap does not much more than pay for the labor performed.

A permanent wrecking derrick should be pro-

vided in close proximity to the scrap yard where heavy materials, usually consisting of trucks and heavy material received from the line, can be loaded and unloaded. A great saving can thus be effected by the labor saved through the lesser number of men required to handle heavy material.

The grouping of these shops and tracks should be of such a character as to enable materials from the mill, blacksmith shop, etc., to be transported from shop to shop at a minimum cost. No fixed plan can be laid down for a shop of this character for the reason that it must always be made to meet the land and track conditions in and about the yards in which it is built.

The system under which work is conducted must necessarily be varied to meet track and switching conditions in the yard. The best practice, however, in important yards where both heavy and light repairs are handled, is to have an inspector inspect all cars received from outlying divisions; and in this inspection, he should be the judge as to the classification of repairs to be made—which classification should be the basis for determining where car should be placed and what work is needed to place the car in first class repair.

All bad order cars on which repairs can be made in one day or less should be grouped and classed as "A" (light) repairs, and a card known as the "A" card applied to each car. This card indicates the initial, number of car, classification of repair work needed, together with a space for the name of the inspector. Cars which require more than one day and less than two days for

making the repairs should be classified as "B". Those requiring two days or more as "C" repairs. These cards should be of different colors to enable the switch crews to determine at a glance what disposition should be made of the car; and all cars of the different classes should be set on a track by themselves, and the work got out uniformly, thus avoiding the re-switching of the cars and the holding of same, as would be the case if heavy and light repairs were mixed indiscriminately on the track.

Good practice requires that such parts of cars as require painting, be done first to enable them to receive a coat of paint while on the repair track prior to going onto the regular paint tracks. This greatly facilitates the work of painting.

Wrecked cars, or those so badly damaged as to extend beyond the class "C" repairs, should have repairs made under cover in a shop especially provided for this class of work.

Cars requiring light repairs should always be given preference over the heavy, the heavy repairs being held until such time as the light repair work slackens, as this practice will tend to reduce the number of bad order cars held for repairs to the minimum, thus enabling a larger number of cars to be continued in service. Under certain conditions heavy repair cars are often held what is apparently an unusual length of time, but this is found desirable when the force cannot be regularly employed on both heavy and light repairs at the same time.

The arrangement of the machinery in the

planing mill is of such importance that the most careful attention should be given it to enable the work to be done in such a manner as to have that of a heavy character moved straight through the mill and never backwards. This can be done by means of wooden horses or dollys for shifting heavy materials from one machine to another and so enable the men to take the rough material in at one end of the mill and turn out the finished product at the other with the minimum amount of delay.

Light materials taken out of the mill should in all cases be got out on trucks to avoid laying them on the floor and reloading them. A great saving in time can be made by the foremen if particular attention is paid to this.

The matter of conveying the shavings and offfall from the machines and saws, to the boiler room, is one of the utmost importance, and modern methods for so doing should in all cases be employed.

The Pattern Shop and Cabinet Shop should be in the same room if possible, as the machinery employed in the two departments of the work is practically the same and by so associating them, the same machines will answer the purposes of both departments.

The location of the machine and blacksmith shops should be such as to enable the heavy materials to be got out in these departments and transferred or loaded at the minimum cost.

Tracks for the storage of wheels mounted for use should be sufficiently close to the "Pressing

off and on machinery" as to enable quick delivery of same to be made. Tracks should be inclined away from the machine shop toward the point where loading and unloading is done, as this allows the wheels to be taken from the tracks in the order that they are mounted. Great care should be exercised in using first the oldest wheels on track; this on account of the time guarantee on freight wheels.

Tracks on which wheels are stored to be dismounted, should be inclined toward the shop to have them move by gravity to as great an extent as possible.

The best method of loading and unloading mounted wheels has been found in the use of the piston jack (see illustration on next page), located in the ground and operated with air pressure to raise the wheels up to car level, rather than to use the old style derricks.

The jacking up of cars, the cleaning of air brake cylinders and triple valves and the testing of air brakes by means of air pressure have been found to cut so much figure in economy and cost, that the greatest consideration should be given the same in the arrangements of the yard.

At terminal stations sufficient trackage should be provided, conveniently located, to enable bad order cars to be switched out of trains and got to and from the repair yards without interference with other equipment. These tracks should be provided with air for testing air brakes, jacking up cars, etc. A stock house of sufficient capacity should also be provided to properly care for such

PINTON JACK

This appliance is located between the rails of the car track and is used to raise mounted wheels to or lower them from the rails of Rondolia cars with drop ends. The car to be lifted is run over the jack with the wheels between the rails. Pinions are fixed on the ends of the axle, which engage with the teeth of the rack. The rack is moved up or down by the action of the hand wheel, which is connected with the pinion by a shaft and bevel gears. The hand wheel is provided with a ratchet and pawl to hold the rack in any position. The jack is operated by one man.

materials as are used in and about a yard of this kind, where machinery and smith work is necessarily limited to that which can be procured from the Main Shops, the work being confined to that which can be done with materials of this kind.

At local points of sufficient importance, tracks holding a limited number of cars conveniently located should be provided; also a small stock house for the storage of waste and oil and such other materials as are ordinarily used in work of what is known as light or running repairs.

The lubrication of cars is a question upon which more could be said than can be outlined in this article. Briefly, the yards where heavy repairs are made to cars, should be equipped with an oil house having apparatus therein for the sorting of the waste; steam heating tanks where the waste can be heated to the proper degree of temperature; presses where condemned waste can be pressed and the oil extracted from it and the condemned waste sent to the locomotive department for firing up engines. The usable waste that has been sorted, should be mixed with new. Soaking vats should be provided where the waste can be placed in oil for soaking, and draining racks in which it can be placed for draining off the superfluous oil.

The condemned waste removed and used for firing up engines is of sufficient value to pay the entire expense involved in the operation. The oil extracted is clear gain.

All waste should be soaked at least 24 hours before using (the longer the better). Journal

boxes of all cars undergoing heavy repairs, if not repacked within two years, should have all the waste removed and taken to the oil house and disposed of as indicated above; that which is usable should be mixed with new waste and soaked and the boxes repacked. The benefits gained by this practice are great.

At outside yards and terminals where light and running repairs only are made, the shop should be provided with oil tanks, soaking vats and draining racks, so that a sufficient quantity of waste properly saturated may be carried in stock at all times for renewal.

At local points where cars are cared for while en route the same provision should be made, and cans for properly saturated waste, or combination cans for oil and waste, should be stored in the yards for convenient use when necessary.

The repairs of air brakes is a matter which needs the most careful attention. Large expenditures are made in fitting cars with these appliances and the practice of letting the hose hang down from the end of the cars results in much sand and dirt being carried into the train pipe, through the strainers and into the triple valves. In many cases, the smaller particles of sand reach the cylinders where it has a tendency to cut the leather packing.

All well equipped shops are provided with necessary tools and appliances for cleaning and making light repairs to triple valves. Repairs of a heavy character should be sent to the Air Brake company originally furnishing the valves,

as an ordinary car shop is not equipped to do work sufficiently accurate for a piece of machinery of this character. Valves from the yards and the road should be sent to the shop where they can be repaired and cared for as indicated. The cleaning of air brake cylinders and the removal and replacement of the triple valves should be done in all cases when the valves have been in service eight months or more. The tightening up of leaky joints; removal and replacement of angle cocks, hose and couplings; the tightening up of air brake pipes and cylinders; the removal and replacement of worn out brake shoes; and the testing and adjusting of the apparatus should be performed in the repair yards, on warehouse tracks, on team tracks and other tracks when the cars are stored there a sufficient length of time, and it is possible for them to be reached with air pipes for the purpose of testing. The work should be done by a man especially skilled in work of this character.

The passenger equipment of a railroad is so valuable and its maintenance comprises so great a percentage of cost, that it must be handled with the most complete organization and best arranged shops to insure its maintenance at the minimum cost. The organization for conducting the work is, substantially, as follows:

Foreman of Passenger Repairing or Carpenter Shop. His duties embrace the general work of repairing and maintaining the passenger cars in so far as the woodwork of the car is concerned;

also the direction of the iron, paint, tin and upholstering departments.

Foreman of Trimming Department. His duties comprise a general inspection of cars on their arrival at the shop. He reports, on form provided, all work to be performed on the cars. He has charge of the force which strips or removes from the cars, the doors, sash, blinds, seats, trimmings, etc.: has the same properly marked and tabulated and delivered to the proper department where the work of cleaning, repairing, etc. is performed. Also the assembling and re-trimming of the cars after the general work of repairs is finished.

Foreman of Truck and Platform Repairs. He is in charge of the men employed on the work of repairing all portions of trucks and platforms, including air brakes.

Foreman Tinner. His duties are to look after the repairs of all portions of the car pertaining to the tin department.

Foreman Upholsterer. His duties comprise the transporting of seats and backs, curtains, carpets, etc. from the cars to the upholstering cleaning department, properly cleaning and repairing the same and re-conveying to the car when finished and ready for service.

Foreman Painter. His duties comprise the determining of the class of painting and the work to be done on the car and the supervision of the same.

Foreman of the Cabinet Department. His duties comprise the construction of and repairs to interior parts of the cars.

Where the work of maintaining passenger cars is conducted at shops where freight car repairing is performed, the foreman of the planing mill, machine shop and blacksmith shop, necessarily performs the work that must be done for both departments, passenger and freight.

Foreman of Outside Cleaning Yards. He is located at terminal stations and his duties comprise the making of light and running repairs, the cleaning and caring for cars while the same are in service.

Inspectors at Terminal Stations. His duties comprise the general inspection of all parts of the car for the purpose of determining as to its safety for transporting passengers on the line.

Local Inspectors. These are located at the principal stations along the line and their duties comprise the inspection of trains while in transit, the lubrication and care of same, and making such light repairs as are found necessary.

The grouping of buildings for the maintenance of passenger cars depends very largely on the ground space and arrangement of the tracks. A desirable arrangement is that which will bring them in such relation to each other as to facilitate the transfer of interior furnishings of the car comprised of seats, backs, curtains, carpets, upholstering, etc., to and from the upholstering department; the parts of the seats, etc., to be repaired by the cabinet department; the doors, sash, blinds, etc., that go to the carpenter shop for repairs; and, finally, convenient facilities

for reaching the varnish room and the car on its completion.

A sufficient number of tracks should be set aside for the repairs of trucks of all passenger cars received at the shops for repairs. The trucks should be removed and transported to the tracks provided, where they should receive thorough overhauling, first in squaring the truck frames; second the removal and replacement of worn or broken parts; third the removal and replacement of worn out wheels and journals.

The introduction of the air brake and in many cases large tanks for water and gas, often necessitates the removal of the trucks at the end of the car; one on either side of the shop. When this is done, one truck can be transported on the ordinary car transfer table, while on the other side there should be a ground rail laid with a transfer truck on which the car trucks can be jacked to a sufficient height and transported to the tracks on which the repairs can be made.

A desirable shop for the repairs and painting of passenger cars should be rectangular in shape and each track should hold one car, the width of the building should be not less than 85 feet. The number of tracks per shop depends upon the ground space and the number of cars to be repaired. A well organized and managed shop will turn out from each track therein, three to four cars per month depending on the number of men employed.

It is desirable that the carpenter and truck repairing shops be provided with the same num-

ber of tracks as are the paint shops. This is especially desirable in view of the fact that touching up and varnishing can be done in the carpenter shop when found advisable.

The car transfer tables should be not less than 65 feet in length, and operated by electricity both in the movement of the table itself and in the arrangement for pulling cars in and out of the shops and located in such a manner as to best meet the location of the shop buildings.

It is not advisable to have upholstering, cabinet, tin, or other shops on the second floor of repair buildings, except when ground space is so limited as to require it; danger from fire is much greater in the case of two-story structures, while the expense of operating elevators in raising and lowering material largely increases the cost.

CHAPTER XI.

Forms by the Aid of Which Those in Charge Are Advised of the Needs, Workings and Results Achieved in the Car Department.

The forms used in connection with the work are the far-reaching eyes — the long distance glasses — through which the Superintendent of the Car Department and his assistants scan the vast and widely extended territory over which cars are scattered; but where, nevertheless, their safety and maintenance must be carefully looked after every hour of the day. Without them, effective supervision would be impossible. Their supreme value is therefore apparent.

These forms, like all those used by railway companies, are not only extremely interesting for the specific things they cover, but also for the things they suggest. They are very simple — like all railway blanks — being designed to save clerical work and at the same time convey the maximum amount of information within the smallest possible compass. All those which follow relate directly to work connected with the great branch of the service devoted to the operation, care, maintenance and supervision of cars.

C. R. Form I

REQUISITION FOR AND INVOICE OF MATERIAL.

_____ 19__

_____ Requisition No._____

_____

Dear Sir:—Requisition is hereby made for the Material called for below

Please send without delay to_____at_____

and send the Invoice to_____at_____

Certified to_____Date,_____19___ | _____Date,_____19___

Certified to_____Date,_____19___ | Approved: _____Date,_____19___

NOTE.—This blank should be used in ordering material—the quantity "Now on hand", "Due on previous requisitions" and "Additional quantity wanted", and "Kind of material" being entered in the proper places by the person making the requisition.

Upon receipt of the requisition, properly approved, the official upon whom it is drawn will forward the material in accordance with the directions given above. A record of any items which cannot be supplied at once should be made, such material to be shipped as soon as possible, and the person making the requisition promptly notified of the probable date of shipment.

All items shipped should be invoiced (on this blank) to the proper person, as directed above, showing date and initials and number of car in which shipped, and quantity, price and amount in the spaces provided. Before forwarding the invoice, a tissue copy of it should be taken in a record book by the storekeeper, or official filling the requisition.

The person receiving the invoice should refer it to the person to whom the material was shipped—who should compare it with the record of material received, and in the event of error or omission, or in case there is any variation or deficiency, either in quality or quantity, the account must be corrected accordingly and the person filling up the invoice notified.

Quantity of Material			Kind of Material	Invoice of Material Shipped Date_____ No. Car____ Initials_____		
Now on hand	Due on previous requisitions	Additional quantity wanted	In ordering material, please keep within space set apart below	Quantity	Price	Amount

C. D. Form 1—A.

NOTICE OF MATERIAL ORDERED.

_____ 19___

_____ Requisition No._____

The material called for below has been ordered from above named official

to be sent to_____at_____

and to be invoiced to _____at_____

NOTE.—This notice will be sent to the person who is to receive the material, for his information and use in checking the material when received.

Signed:

_____Date, 19___

Quantity of Material			KIND OF MATERIAL	Material received			
Now on hand	Due on previous requisitions	Additional quantity wanted		Quantity	Date	Car	Invoice checked

C. R. Form 1-A.

RECORD OF MATERIAL ORDERED.

_____ 19__

_____ Requisition No._____

_____

Record of material ordered from above named c°.

to be sent to_____ _____ at_____

and to be invoiced to_____ at_____

NOTE.—This copy will be retained as a record by the person making the Requisition and must be filed in consecutive order according to the number.

Signed;

_____ Date_____ 19__

QUANTITY OF MATERIAL			KIND OF MATERIAL	INVOICE CHECKED		
Now on hand	Due on previous requisitions	Additional quantity wanted		Invoice from	Date of receipt	Date checked

C. D. Form 2.

FOREMAN'S ORDER FOR MATERIAL REQUIRED FOR IMMEDIATE USE.

NOTE.—This form is to be used in ordering supplies from the storehouse for immediate use. The weight, price and amount columns are to be left blank to be filled in by the storekeeper, after which the amount is charged, by him, on the distribution of material book to the proper account.

To_____ _____ Shop, _____ 19____
Storekeeper.

Please deliver to bearer the following articles, _____ Foreman.

Quantity.	Description of Article.	Weight.	Price.	Amount.

Chargeable to_____

C. D. Form 3.

FOREMAN'S MONTHLY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF OIL AND WASTE USED IN CAR DEPARTMENT.

At _____ Station, during the month of _____, 19____

NOTE.—This statement is to be compiled promptly at the end of the month by the foreman at each point where oil and waste are disbursed and forwarded to the superintendent of car department. The amount "on hand last day of month" should equal the amount "on hand last report" plus the amount "received during current month" after deducting amount "used during the current month" for the purposes specified.

KIND OF LUBRICANT	ON HAND LAST REPORT	Received during current month	TOTAL	USED DURING CURRENT MONTH									ON HAND LAST DAY OF MONTH
				On sleeping cars	On other pass'r. cars	Delivered to pass'r. trainmen on orders	On freight cars	Delivered to freight trainmen on orders	On gravel construct. and hand cars	Delivered to engines on orders	For other purposes	TOTAL	
Car oil													
Special coach oil													
Woolen waste													
Cotton waste													

C. D. Form 4.

MONTHLY STATEMENT OF COMPARATIVE QUANTITY AND COST OF OIL, WASTE AND TALLOW USED ON CARS.

PASSENGER CARS.

	NUMBER OF MILES	NUMBER OF		MILES RUN TO ONE		COST PER 1000 MLS. FOR	
		Gals. oil	Lbs. waste	Gal. oil	Lb. waste	Oil	Waste
____ 19							
____ 19							
Increase							
Decrease							

FREIGHT CARS.

	NUMBER OF MILES	NUMBER OF		MILES RUN TO ONE		COST PER 1000 MLS. FOR	
		Gals. oil	Lbs. waste	Gal. oil	Lb. waste	Oil	Waste
____ 19							
____ 19							
Increase							
Decrease							

PASSENGER CARS.

ITEMS	____ 19__		____ 19__		INCREASE		DECREASE	
	Amount	Cost	Amount	Cost	Amount	Cost	Amount	Cost
Tallow,								
Oil,								
Waste,								

FREIGHT CARS.

ITEMS	____ 19__		____ 19__		INCREASE		DECREASE	
	Amount	Cost	Amount	Cost	Amount	Cost	Amount	Cost
Oil.								
Waste,								

TOTAL, 19
" 19

In....., 19 , Car Oil was $ per gallon; Waste $ and Tallow $ per lb.
In....., 19 , Car Oil was $ per gallon; Waste $ and Tallow $ per lb.

C. D. Form 8.

FOREMAN'S MONTHLY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF PARTICULARS OF STEEL TIRED WHEELS APPLIED TO OR REMOVED FROM CARS.

At _____ _ _____ shops. For the month of _ _ _ _ _ . 19

NOTE.—This report must be forwarded on the first day of the month to the Superintendent of Car Department and must include all steel tired car wheels that have been exchanged during the preceding month showing each wheel separately.

WHEELS REMOVED								WHEELS APPLIED		
DATE	CAR			Size of wheels	MAKERS	Serial letter and number of tires	CAUSE OF REMOVAL	Size of wheels	MAKERS	Serial letter and number of tires
	Initials	Number	Kind							

C. B. Form 6.

FOREMAN'S MONTHLY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF PARTICULARS OF CAST IRON WHEELS REMOVED FROM PASSENGER CARS.

At_____ Shops. During the month of_____ 19___

NOTE.—A report (on this form) is to be sent to the superintendent of car department on the first day of each month showing every cast iron wheel removed from passenger cars during the preceding month. In reporting defective wheels care must be taken to designate defects accurately: whether shelled out on tread; seams in tread; comby; worn hollow, flat from sliding; sharp flange; burst (*i. e.*, cracked from axle out); cracked inside or outside plate; broken flange or rim; etc. Special care should also be taken to state whether or not wheels can be used in freight service.

CAR		SIZE OF WHEEL	MAKER	DATE			CAUSE OF REMOVAL	Condemned or can be used in freight service	This column is to be left blank for the use of Supt. Car Dept. to enter the mileage made by wheels.
NO.	CLASS			CAST	APPLIED	REMOVED			MILEAGE

C. D. Form 7.

MONTHLY REPORT OF SUPERINTENDENT OF CAR DEPARTMENT OF THE GROSS NUMBER OF DEFECTIVE CAST IRON PASSENGER WHEELS REMOVED AND THE NAMES OF THE MANUFACTURERS.

For the whole road, for the month of_____ 19____

NOTE.—This statement is compiled by the superintendent of car department and is sent to the officials interested as soon after the first of the month as the information can be obtained.

MAKER'S NAME	Wheels removed on account of sliding.		Wheels removed on account of sharp flanges.		Defective wheels removed for all other causes		Total number of wheels removed for all causes.		No. of wheels held for exchange that did not make guarantee.
	No. of wheels	Average mileage	No. of wheels	Average mileage	No. of wheels	Average mileage	No. of wheels	Average mileage	
TOTALS									

C. D. Form 8.

FOREMAN'S MONTHLY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF PARTICULARS OF WHEELS REMOVED FROM FREIGHT CARS

At _____ Shops during the month of _____ 19____

NOTE.—This report is to be sent to the superintendent of car department on the first day of each month for all wheels removed from freight cars during the preceding month. In reporting defective wheels care must be taken to designate defects accurately: whether shelled out on tread; seams in tread; comby; worn hollow; flat from sliding; sharp flange; burst (*i. e.*, cracked from axle out); cracked inside or outside plate; broken flange or rim, etc., etc. In cases where only one of the wheels on an axle is defective, the defective wheel only should be reported.

CAR			Size of wheel	Maker	DATE			WHERE REMOVED	Length of service	CAUSE OF REMOVAL
Number	Initial	Kind			CAST	APPLIED	REMOVED			

C. D. Form 9.

MONTHLY REPORT OF SUPERINTENDENT OF CAR DEPARTMENT OF THE GROSS NUMBER OF DEFECTIVE FREIGHT WHEELS REMOVED, AND THE NAMES OF THE MANUFACTURERS.

For the whole road, for the month of_____ 19____

NOTE.—This summary is compiled for the whole road by the superintendent of car department from form 8, and is sent to the officials interested as soon after the first of the following month as the information can be obtained.

MAKER'S NAME	Wheels removed on account of sliding.			Wheels removed on account of sharp flanges.			Wheels removed on account of other defects.			Total number of wheels removed for all causes.			No. of wheels that did not fulfill guarantees, held for exchange
	No. of wheels	Av. length of serv.		No. of wheels	Av. length of serv.		No. of wheels	Av. length of serv.		No. of wheels	Av. length of serv.		
		Years	Months		Years	Months		Years	Months		Years	Months	
TOTALS													

C. D. Form 10.

MONTHLY REPORT OF SUPERINTENDENT OF CAR DEPARTMENT OF WHEELS THAT HAVE FAILED TO MEET THE GUARANTEES OF MANUFACTURERS.

The purpose of this report is to furnish information for use in making bills against manufacturers for wheels that have failed to fulfill the guarantees. The items to be included are the deficiency for each wheel; also the cost of removing the wheel from the axle. The cost of removing passenger wheels is, we will say, 75c each; and of freight wheels say 50c each. The rate of deficiency is figured on the following basis: From the cost of the new wheel is deducted the amount received for the wheel as scrap. The difference represents the net cost of the wheel for the length of service for which it is guaranteed. The value of the full period being thus ascertained, the amount to be billed against the manufacturer for the deficiency is computed proportionately. For example: a 33 inch—750 lb. freight wheel is guaranteed, we will suppose, for seventy-two months.

Value of new wheel, - -	$8.00
Less scrap value, - - -	3.68
Net value, - - - -	$4.32

$4.32 divided by 72 months equals 6 cents per month. If the wheel was in service thirty months, the difference between seventy-two months and thirty months (forty-two months) multiplied by .06c per month will give the amount of the deficiency, which is $2.52, the amount to be included in the bill, plus the 50c for removal; or a total of $3.02.

C. D. Form 16.

MONTHLY REPORT OF SUPERINTENDENT OF CAR DEPARTMENT OF WHEELS THAT HAVE FAILED TO MEET THE GUARANTEES OF MANUFACTURERS.

Defective wheels removed from_____cars during the month of_____19___

Manufactured by_____

NOTE.—This statement is compiled by the superintendent of car department and forwarded to the officials interested as soon after the first of the following month as the wheel mileage can be obtained. All cast iron passenger wheels failing to make their mileage guarantee, and all freight wheels failing to make their time guarantee are included in this report. The actual service for each wheel that has failed should be shown and bill made by the proper officer against the manufacturer for the total deficiency.

CAR		No. of wheels	Size	Wght.	Kind	DATE						GUARANTEE		SERVICE		DEFICIENCY		CAUSE OF REMOVAL
						CAST		APPLIED		REMOVED								
No.	Class					Mo.	Yr.	Mo.	Yr.	Mo.	Yr.	Mos.	Mileage	Mos.	Mileage	Mos.	Mileage	

C. D. Form 11

FOREMAN'S DAILY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF PARTICULARS OF STEEL TIRED CAR WHEELS TURNED.

At_____ Shop. Date_____ 19____

NOTE.—This report should be made daily to the superintendent of car department by the foreman at shop where steel tired car wheels are turned.

REPORT OF FOREMAN					THIS SPACE IS TO BE LEFT BLANK FOR USE OF SUPT. CAR DEPT.		
Size of wheel	MAKE	Serial letter and number of tire	Thickness after turning	Amount reduced	Mileage since tire was last turned	Reduction in diameter of wheel	REMARKS

C. D. Form 12.

INSPECTOR'S REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF PARTICULARS OF FLAT WHEELS UNDER PASSENGER CARS.

At_____ Station. Date_____ 19____

NOTE.—This report is to be made to the superintendent of car department by the car wheel inspector immediately upon discovery of a flat wheel. The inspector should, however, be governed by the following conditions in the removal of flat wheels: If the spots are large enough to impair the safety of the wheel the wheel should be removed: or if they cause annoyance from riding roughly: or if they are so large they will not wear off.

When there are flat wheels under cars received from a foreign company the inspector should see that "defect" cards are furnished by such company.

CAR			TRAIN NO.	ENG. NO.	NO. PAIRS WHEELS SLID	SIZE OF SPOTS	NEW OR OLD SPOTS	STEEL TIRED OR CAST WHEELS	NAME OF ROAD FURNISHING DEFECT CARD	NO. PAIRS WHEELS REMOVED
INITIALS	CLASS	NAME or NO.								

C. D. Form 1a.

INSPECTOR'S REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF PARTICULARS OF HOT BOXES.

At_____ Date_____ 19____

NOTE.—This report must be forwarded immediately by the inspector to the superintendent of car department whenever a delay is caused by hot boxes. The actual time of delay, in minutes, must be shown. When hot boxes occur, but no delay to train is caused, no report need be made.

NO. OF TRAIN	NAME OF CONDUCTOR	CAR		NO. OF HOT BOXES	TIME DELAYED	CAUSE OF HOT BOX	REMARKS
		INITIAL	NUMBER				
					Minutes		
					"		
					"		
					"		
					"		
					"		

C. B. Form 14.

FOREMAN'S WEEKLY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF CYLINDERS AND TRIPLE VALVES CLEANED AND OILED.

At_____ Station. For the week ending_____ 19___

NOTE.—A report of this nature must be forwarded to the superintendent of car department by the foreman for all cylinders and triple valves cleaned and oiled, and air brakes tested and adjusted.

CAR		Date of previous cleaning as stenciled
Number	Initial	

C. D. Form 15.
(See form 15¼ below.)

CAR REPAIRER'S REPORT OF PARTICULARS OF SPECIAL REPAIRS MADE ALONG THE LINE.

NOTE.—A blank of this form is to be attached to the order directing a car repairer to go out on the road to make repairs.

It is intended to furnish the information necessary to a proper supervision over the doings of such car repairers.

Date.	Time consumed in going and coming.	Time consumed in doing the work.	Could the car have been forwarded by being chained?

NATURE OF REPAIRS MADE.

C. D. Form 15¼.

INSPECTOR'S "BAD ORDER" CARD—TO BE ATTACHED TO CARS NEEDING REPAIRS.

NOTE.—In case cars are damaged along the line or at points where no provision is made for repairing, it is desirable to get them to repair yards where the work can be done effectively and economically rather than to send repairers out on the line especially to do the work.

This card (printed on heavy red card-board in conspicuous type) is used more particularly along the line than at shops, where other provision is made. It is attached to the sides of the cars to prevent cars being loaded, and to designate the point to which the cars are to be sent for repairs.

BAD ORDER

To be Repaired at_____

_____Inspector

C. B. Form 14.

FOREMAN'S DAILY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF CARS DAMAGED IN SWITCHING.

At_____ Station. Date_____ 19__

NOTE.—This report is to be sent to the superintendent of car department and should include an account of all cars damaged in switching or otherwise at stations.

Date.	CAR.		Description of Damage.	Cause of Damage.
	Initial.	No.		

The purpose of this report is to advise the superintendent of car department daily of all cars damaged as stated; this for purposes of record and that corrective measures may be enforced when the damage is caused by carelessness or neglect.

FOREMAN'S REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF PARTICULARS OF CONDEMNED AND WORN OUT CARS.

_____ Station. Date _____ 19____

NOTE.—This form should be sent to the superintendent of car department whenever there are damaged and worn out cars to be reported. Care must be exercised in stating cause of the condition of the cars. In cases of cars being wrecked the date and place of wreck should be given. The superintendent of car department will direct disposition to be made of cars.

REPORT OF FOREMAN						DISPOSITION TO BE MADE OF CARS (This column is to be left blank for use of superintendent car department)
Initial	Number	Class	Length	Age	Cause	

The purpose of this report is to keep the superintendent of car department advised of cars damaged or worn out, and to enable him to decide whether worn out cars should be repaired or destroyed. Cars reported on form C. D. 16 are not included herein except in those cases where the car is destroyed or condemned.

C. D. Form 18.

REPORT OF SUPERINTENDENT OF CAR DEPARTMENT TO YARD MASTER OF CARS READY FOR SERVICE IN REPAIR YARD

At_____ Date_____ 19___ ___M.

NOTE.—This form is used by the superintendent of car department to notify the yard master of cars to be put in service that have been repaired and for which special disposition has been made. It is also sometimes used as a medium for ordering other cars (home and foreign) to be moved.

The following cars are now ready for service	Destination

C. D. Form 19.

REPAIR YARD FOREMAN'S DAILY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF CARS IN REPAIR YARD READY FOR SERVICE, NOT INCLUDING FOREIGN CARS.

At_____ Date_____ 19___

NOTE.—This form should be used by the repair yard foreman at car shops to report to the superintendent of car department daily the number of each class of cars that have been repaired and are ready for service. The superintendent in turn advises the car service agent in order that he may make disposition of same.

Box	Cars	
Ice	"	
Furniture	"	
Stock	"	
Gondola	"	
Flat	"	
Beer	"	
Refrigerator	"	
Gravel	"	
Ore	"	
Way	"	
Raised Center	"	
Charcoal	"	
Hay	"	
Loads	"	
Cinder	"	
Coal Sides	"	
Vegetable	"	
Boarding	"	
Tool	"	
	Total,	

The object of this report is to keep the superintendent of car department and the car service agent advised of the number of the different classes of cars in repair yard ready for service so that the cars may be put into service with as little delay as possible. The total number in yard will be reported daily without reference to whether they have been reported before or not.

C. D. Form 20.

REPAIR YARD FOREMAN'S DAILY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF FOREIGN CARS IN REPAIR YARD READY FOR SERVICE.

At_____ Date_____ 19___

NOTE.—This blank is to be used by the repair yard foreman to report to the superintendent of car department daily the number of foreign cars repaired and ready for service. He will in turn advise the car service agent in order that proper disposition of the same may be made without delay.

Car Nos.	Initial.	Class.	Destination.

C. D. Form 21.

DAILY REPORT OF SUPERINTENDENT OF CAR DEPARTMENT TO CAR SERVICE AGENT OF FREIGHT CARS RECEIVED FOR REPAIRS AND CARS REPAIRED AND READY FOR SERVICE.

At_____ Date_____ 19___

NOTE.—This letter of advice should be made daily to the car service agent by the superintendent of car department. Its purpose is to keep the car service agent advised regarding freight cars set aside for repairs, and those that have been repaired and are ready for service.

CARS RECEIVED FOR REPAIRS		CARS REPLACED IN SERVICE	
Initials	Numbers	Initials	Numbers

C. B. Form 22.

REPORT OF SUPERINTENDENT OF CAR DEPARTMENT OF PARTICULARS OF NEW EQUIPMENT RECEIVED.

At_____ Date_____ 19___

NOTE.—This report is to be made by the superintendent of car department to the proper official of new equipment received and the date when it will go into service.

	By whom built.	Class of equipment.	Initials and Numbers.	Date will go into service.

C. D. Form 28.

Weekly Report of Superintendent of Car Department of Particulars of Cars Destroyed.

This report is valuable to Operating officials and others as current information in regard to the car equipment. It is in fact a copy of the record kept in the office of the Superintendent of Car Department of the cars destroyed and the reason therefor during the period for which return is made. It is to be remembered in this connection that a historical record is kept of every car: its number, by whom made, when it entered the service, date of its destruction, and other particulars, as recounted elsewhere. This historical record, therefore, furnishes accurate information in regard to each car whether still in the service or broken up. And it is to this record that the officers go to find numbers for the new cars put in service to replace those that have been destroyed; and also to find the deficiencies that exist in the car equipment.

C. D. Form 21

WEEKLY REPORT OF SUPERINTENDENT OF CAR DEPARTMENT OF PARTICULARS OF CARS DESTROYED.

For the week ending _____ 19___

NOTE:—A report of this nature is to be made weekly by the superintendent of car department to the proper officers giving an account of all cars destroyed.

Initial.	Class.	Number.	Length	Capacity.	When built.	DESTROYED.		Cause of destruction.	AGE.	
						At	Date.		Years.	Mos.

RECAPITULATION.

Class.	NUMBER.			AVERAGE AGE.		
	Age and decay.	Wreck and damage.	Total.	Age and decay.	Wreck and damage.	Total.

C. D. Form 24.

REPAIR YARD FOREMAN'S DAILY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF REPAIRED AND BAD ORDER CARS ON HAND.

At_____ Date_____ 19___

NOTE.—This report should be made at the close of each day's work and sent to the superintendent of car department by all repair yard foremen. It should show the total number of bad order cars on hand needing heavy and light repairs and the number of cars on hand that have received such repairs. Aside from this the box cars are shown separately.

	Bad Order Cars		Cars repaired		Painted	Air Brakes Applied	Remarks
	Heavy repairs	Light repairs	Heavy repairs	Light repairs			
Total No. of cars of all kinds							
Total No. of box cars							

The object of this report is to keep the superintendent advised of the number of bad order and repaired cars on hand, not in service, and the amount of work to be done on the former; this with the object of taking such measures as may be necessary. It will be noticed that the number of cars is given in gross in the first instance, only box cars being particularized afterwards. It would, perhaps, add to the value of the report in some cases if each class of cars were specified instead of being bulked.

C. D. Form 25.

DAILY REPORT OF SUPERINTENDENT OF CAR DEPARTMENT OF REPAIRED AND BAD ORDER CARS ON HAND.

Date_____19____

NOTE.—This report for the whole road is compiled daily by the superintendent of car department. It is a summary of form 24. A copy is sent by him to each of the officials interested in the movement of cars.

Place.	BAD ORDER CARS.		CARS REPAIRED.	
	Total of all cars.	Box cars.	Total of all cars.	Box cars.
Total,				

This report is a summary of form 24, and is made for the information of officers interested. It furnishes information regarding all cars on hand in bad order or that have been repaired and await service in the various repair yards of the company. The number of box cars is shown separately because of the great demand for that class of cars. It would, perhaps, add to the value of the report if each of the other classes of cars were similarly particularized. On one road coal cars might predominate; on another road, ore cars, and so on.

C. D, Form 26.

SEMI-WEEKLY REPORT OF SUPERINTENDENT OF CAR DEPARTMENT OF PASSENGER AND FREIGHT CARS TO BE REPAIRED OR REBUILT.

Date_____ 19

NOTE.—This report is made by the superintendent of car department to the operating officers interested in such matters.

Classification.	To be repaired.	To be rebuilt.	Remarks.
Passenger			
Dining			
Sleepers			
Beer			
Boarding			
Box			
Derrick			
Ditching			
Dump			
Excavator			
Flat			
Furniture			
Foreign			
Gondola			
Ore			
Pile driver			
Refrigerator			
Stock			
Way			
Totals			

C. D. Form 27.

WEEKLY REPORT OF SUPERINTENDENT OF CAR DEPARTMENT TO CAR SERVICE AGENT OF PARTICULARS OF PASSENGER CARS TO BE REPAIRED OR REBUILT.

at_____Shop. For the week ending_____19____

NOTE.—This report is made weekly to the car service agent by the superintendent of car department and keeps the former advised of cars temporarily withdrawn from service and when they will be reinstated.

Number.	Class.	Route in service.	Repairs needed.	DATE.	
				Received.	Expected out.

C. D. Form 28.

MONTHLY REPORT OF SUPERINTENDENT OF CAR DEPARTMENT OF PARTICULARS OF PASSENGER CARS REPAIRED AND REPAINTED.

At_____. For the month of_____19____

NOTE.—This report is made by the superintendent of car department to the officials interested on the first day of the month.

CLASSIFICATION.	Light repairs.	General repairs; paint burned off and car repainted.	General repairs: repainted over old paint.	General repairs; paint touched up and car varnished.	TOTALS.
Buffet cars,					
Chair cars,					
Dining cars,					
Parlor cars,					
Sleeping cars,					
First-class passenger.					
Second-class passenger,					
Directors' and superintendents' cars,					
Combination passenger, baggage and mail,					
Combination passenger and baggage,					
Baggage and express cars,					
Postal cars,					
Milk cars,					
TOTALS,					

The object of this return is to keep those interested advised of the work in progress on passenger cars and the character of the repairs. Like all similar returns it also helps the management to determine as to the reasonableness of the pay-roll.

C. D. Form 29.

FOREMAN'S WEEKLY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF PARTICULARS OF REPAIRS MADE ON FREIGHT CARS.

At_____ shop. For week ending_____ 19____

NOTE.—A report of this form should be sent weekly to the superintendent of car department of repairs made to freight cars at the various shops and stations. It should show the total number of bad order cars received each day needing heavy and light repairs and the number of cars that have received such repairs. The information contained in this report is a summary of the daily report of like nature.

Date	Bad order cars received		Cars repaired		Painted	Air-brakes applied	REMARKS
	Heavy	Light	Heavy	Light			

U. S. Form 30.

WEEKLY REPORT OF SUPERINTENDENT OF CAR DEPARTMENT OF PARTICULARS OF REPAIRS MADE ON FREIGHT CARS AT VARIOUS POINTS.

For the week ending_____19____

NOTE.—This summary is compiled weekly by the superintendent of car department from returns made to him on form C. D. 29. It is sent to the officials interested. It shows the total number of bad order cars received at the various shops and stations needing heavy and light repairs and the number of cars that have received such repairs. A report similar to this is made daily.

SHOP	BAD ORDER CARS RECEIVED		CARS REPAIRED		PAINTED	AIR BRAKES APPLIED	REMARKS
	Heavy	Light	Heavy	Light			

C. D. Form 31

SHOP FOREMAN'S MONTHLY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF MATERIAL USED AND LABOR PERFORMED ON REPAIRS OF SLEEPING CARS.

At_____ During the month of_____ 19____

NOTE.—This report is to be sent to the superintendent of car department on the first day of the month and should show all material furnished and labor expended on sleeping cars, chargeable to the sleeping car company. From these reports the superintendent of car department makes bill against the sleeping car company.

CAR	DATE	LABOR EXCHANGING			Loading and unloading wheels	MISC'L LABOR		MISCELLANEOUS MATERIAL
		Wheels	Brasses	Brake Shoes				
TOTALS								

C. D. Form 32.

FOREMAN'S MONTHLY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF SLEEPING CARS CLEANED.

At_____ During the month of_____ 19___

NOTE.—This report must be sent to the superintendent of car department by the foreman in charge of cleaning yards on the first day of the month. It is the basis of a charge against the sleeping car company for the service performed.

DATE.	NAME OF CAR.

C. D. Form 33.

MONTHLY SUMMARY OF SUPERINTENDENT OF CAR DEPARTMENT OF PARTICULAR SLEEPING CARS CLEANED ON EACH DAY OF THE MONTH.

During the month of_____19____

NOTE.—This statement is compiled by the superintendent of car department from form C. D. 32 and affords the information necessary for making up the account against the sleeping car company for the service performed.

CARS	DATES																													Number of times cleaned
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	

C. D. Form 34.

INSPECTOR'S DAILY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF PARTICULARS OF PASSENGER CARS RECEIVED FROM AND DELIVERED TO FOREIGN LINES.

At_____ Date_____ 19___.

NOTE.—A copy of this report should be sent daily to the superintendent of car department showing in detail the number of all passenger cars delivered to and received from foreign lines at connecting points. Special care should be taken to state fully the condition of each car upon its delivery and on its receipt as such information is valuable in determining the accountability of the respective companies for injuries to cars.

PASSENGER CARS DELIVERED					PASSENGER CARS RECEIVED				
TRAIN NO.	INITIAL	NAME OR NUMBER	TO WHAT COMPANY	DEFECTS	TRAIN NO.	INITIAL	NAME OR NUMBER	FROM WHAT COMPANY	DEFECTS

C. D. Form 35.

FOREMAN'S MONTHLY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF MATERIAL USED AND LABOR PERFORMED ON REPAIRS OF PASSENGER EQUIPMENT IN JOINT SERVICE

Running between_____and_____for the month of_____19____

NOTE.—Foremen at points where work is performed cleaning, inspecting and repairing cars in joint service must keep an accurate record of all labor and material expended on the cars in such service and report the same on this blank, sending it to the office of the superintendent of car department on the first day of each month. It must show the work performed on each car separately. Care must be exercised in making these reports, as bills are compiled from them against the company responsible for the labor and material expended. Foremen doing work on such cars must familiarize themselves with the accountability of the respective companies so that no mistake or omission may occur in rendering bills.

DATE	NUMBER OR NAME	INITIAL	CLASS	MISCELLANEOUS MATERIAL APPLIED	HOURS LABOR	INSPECTED	CLEANED	NO. OF OIL BOXES PACKED	REMARKS

C. D. Form 36.

FOREMAN'S DAILY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF AMOUNT OF GAS SUPPLIED TO CARS.

_____Station Date_____19____

NOTE.—This report is to be made to the superintendent of car department by yard foremen and should show the amount of gas charged in each car daily. The number of cubic feet capacity at one atmosphere multiplied by the number of atmospheres supplied will give the total number of cubic feet supplied.

Name or No. of car	HOLDERS			NO. OF ATMOSPHERES			Total No. of cubic feet supplied.
	NO.	SIZE	No. cubic ft. capacity at one atmosphere	Before filling	After filling	SUPPLIED	

In those cases where cars are lighted with gas a report of this character is exacted in order that a record of consumption may be kept in the office of the superintendent of car department—or elsewhere, as may be required—of the amount of gas charged in each car daily. A report of this kind is necessary—as in cases where oil is used for lighting—not only to properly supervise the work but to furnish necessary information for apportioning the expense when cars are used jointly by two or more roads.

In charging a car the quantity of gas in each holder is first ascertained by means of a gauge showing the number of atmospheres pressure. The holders are then filled with gas until the pressure reaches the specified number of atmospheres (usually 10 atmos.) the difference between the two readings of the gauge showing the number of atmospheres supplied.

C. R. Form 27.

FOREMAN'S MONTHLY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF OPERATION OF PINTSCH GAS PLANT.

Report of operation of Pintsch gas plant at.....for month ending..... 19..

NOTE.—This report is to be made to the superintendent of car department by the foreman in charge of the gas plant on the first day of the month.

Stock of gas on hand at close of last monthly report.....19.. ....cu. ft.

Reading of meter last monthly report..... .....cu. ft.

" " now..... ..... "

Gas made..... .....cu. ft.

Gas to be accounted for..... ..... "

Gas on hand now:

Gas holder No. 1..... .....cu. ft.

" " 2..... ..... "

" " 3..... ..... "

" " 4..... ..... "

" " 5..... ..... "

" " 6..... ..... "

" " 7..... ..... "

" " 8..... ..... "

Total .... "

Gas burned in works .... "

" delivered to cars..... ..... "

Total gas accounted for..... .....cu. ft.

Gas lost by compression and leakage..... ..... "

Percentage of loss to amount made.....

GAS OIL REPORT.

Amount of oil consumed..... .....gals.

" " " per 1,000 cu. ft. of gas made..... ..... "

COST OF OPERATING

Labor ..... $.....

Oil (for making gas) ....

Oil (for fuel)..... .....

Miscellaneous ....

Total..... $.....

Cost per 1,000 cu. ft. of gas made.....

Gas made to 1 gallon of oil.....cu. ft.

Total number of cars charged with gas during the month.....

Average number of cars charged with gas per day.....

C. D. Form 38.

WORKMAN'S DAILY RECORD OF DISTRIBUTION OF LABOR ON MANUFACTURED MATERIAL.

_____ 19____

Check No._____ Rate_____ Name_____

Occupation_____

DAILY DISTRIBUTION OF LABOR.

Hours worked	Pieces Completed	Order number worked on	Description of work	Machine number

Check No._____ C. D. Form 39.

Name_____ Date_____ 19___

WORKMAN'S DAILY REPORT OF DISTRIBUTION OF SHOP LABOR.

Passenger repairs	Freight cars	Work cars	Tools and machinery	Building repairs	Piece work	Miscellaneous (to be specified)	Total

Remarks _____

Examined_____

Foreman_____

This report must be made daily by each employe when not otherwise provided for and must show the number of hours engaged on each kind of work. After being approved by the foreman it is sent to the time keeper to make the proper allowance of time. The report is further used in making the necessary charges on the distribution blanks against the accounts on which the labor was expended.

C. D. Form 40.

FOREMAN'S REPORT OF PIECE WORK PERFORMED BY EACH EMPLOYE.

Check No.....

Shop..... .....Shop,.....19.....

To.....

Please allow.....

occupation.....nature of work..... .....

.....

number of pieces.....rate per.....

.....

time engaged in above work from.....to.....

.....

Charge to.....

Approved:..... .....
Foreman.

This report is to be made to the foreman for each employe engaged on piece work. After being approved by the official in charge the report is sent to the time-keeper and accounting clerk to make the proper allowance of time and such other entries as are necessary. A carbon sheet should be used and the copy retained by the foreman for his record. This blank may be printed on colored paper, to designate it readily from other classes of labor.

C. D. Form 41.

GENERAL TIME BOOK; PARTICULARS OF HOURS WORKED BY EACH MAN; RATE OF PAY; WAGES; AND ON WHAT LABOR WAS EXPENDED.

General time book of men employed at_____ in month of_____ 19___

	DAYS EMPLOYED																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

HOW EMPLOYED (Account to be charged)	Details of work by hours	Total no. hours worked	RATE	Amount chargeable to each account	Total amount wages	NAME	Employe's check number

C. D. Form 42.

FOREMAN'S REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF OVERTIME ALLOWED.

At_____ Date_____ 19___

NOTE.—This report must be sent at once to the superintendent of car department in all cases when overtime is allowed.

NAME	NATURE OF WORK	ACTUAL TIME	TIME ALLOWED	RATE	AMOUNT		AUTHORITY FOR WORK PERFORMED	REMARKS

The object of this report in part, as it is of all returns made to the superintendent and other responsible officers, is to enable them, through supervisory oversight, to judge of the reasonableness and merit of the expenditure, whether nominal, or extraordinary as in this case.

C. D. Form 43.

FOREMAN'S MONTHLY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF MEN HIRED AND DISMISSED.

At_____during the month of_____19____.

NOTE.—This report is to be sent to the superintendent of car department by the foreman on the first day of the month for persons employed and dismissed during the previous month.

Names of men employed	Occupation	Rate

Names of men dismissed	Occupation	Cause of dismissal

As the superintendent is responsible for the organization and management of his department it is necessary that he should keep himself advised of the force employed, how occupied and rate paid—and that no injustice may be done any one he requires that the reason for the dismissal of each employe shall be specifically stated. Information of this nature is also required—and in detail—by companies having a pension system.

FORM OF APPLICATION (IN DUPLICATE) FOR EMPLOYMENT. C. S. Form 44.

NOTE.—This is one of the usual forms of application made by those seeking work of a hazardous nature, such as that about shops and construction work. It is passed upon directly by the employer or head of the department, in the case of corporations. It is distinctly understood that before the applicant can enter permanently into service or be regarded as a regular employe, the written approval of the employer or head of the department must be obtained.

Full name and address of applicant.

Dated at _____ 19___

Place of birth _____ Date of birth _____ 18___ Age _____

Nationality _____ Married or single _____

What position do you desire? _____

What experience have you had in that line? _____

By whom are you employed at present? _____

No. _____ Street _____ Town or City _____ State of _____

In what capacity are you employed at present? _____

Is any one dependent on you for support? If so, give particulars. _____

Give particulars and amount of any debt you owe or liability you are under _____

Do you drink malt or spirituous liquors? _____ What is the condition of your general health? _____

Are you able-bodied? _____ Is your hearing good? _____

Is your eyesight good? _____ Are you able to distinguish colors? _____

Have you ever been injured? If so, when, where, how and extent of injury. _____

Name of last school attended _____

Did you graduate? _____ If not, how long did you attend? _____

State below where and how you have been employed during the last five years making no omission in the record:

TIME OF SERVICE.				NAME OF EMPLOYER. (If the employer was a corporation, give name of such corporation; also name and PRESENT address of official under whom you served.)	PLACE WHERE EMPLOYED.	NATURE OF EMPLOYMENT. (How employed.)	WHY DID YOU LEAVE?
From		To					
Month.	Year.	Month.	Year.				

C. D. Form 44. Continued.

Have you ever been discharged or suspended from any situation? If so, state when, where and under what conditions? _____

Have you ever been in the employ of this Company before? If so, state when, where, in what capacity, and cause of leaving. _____

Give below the name, address and occupation of your parents and other relatives. If any are deceased, give other nearest relatives:

NAME.	OCCUPATION.	ADDRESS.
Father:		
Mother:		
NEAREST MALE RELATIVE		
On Father's side:		
On Mother's side:		

Are any of your relatives in the employ of this Company? If so, state who they are, and in what capacity employed.

_____

Will you faithfully perform such duties as may be legally required of you by your superiors? _____

In consideration of my employment by the _____ company, I agree that whenever I shall sustain any personal injury while in the service of said company I will allow its surgeons and any medical examiners it may select to examine my person and body as often as the company may deem necessary in respect to the alleged injury, and I hereby waive all objections to such surgeons or medical examiners testifying whenever called upon by the company, and I further agree that my refusal to allow any such examination to be made or testimony to be given shall be a bar to the institution or prosecution of any action on account of such injury; and any action pending at the time of such refusal shall at once abate in consequence thereof.

In further consideration of such employment I agree that if, while in the service of said company, I sustain any personal injury for which I shall or may make claim against the company for damages I will, within thirty days after receiving such injury, give notice in writing of such claim to the general claim agent of said company; which notice shall state the time, place, manner and cause of my being injured and the nature and extent of my injuries, and the claim made therefor, to the end that such claim may be fully, fairly and promptly investigated, and my failure to give written notice of such claim in the manner and within the time aforesaid, shall be a bar to the institution of any suit on account of such injuries.

I certify that my answers to the above questions are true, and agree that they shall be the basis of my employment.

Signature of applicant _____

C. D. Form 46.

FORM OF REFERENCE BLANK USED IN INVESTIGATING THE RECORD OF APPLICANTS FOR EMPLOYMENT.

_____ 19___

Mr._____

_____

_____

Dear Sir:—

_____ has made application for position as_____ and states that he was employed by you in the capacity of_____ from_____ 19___ to_____ 19___.

If consistent will you kindly inform me as to the authenticity of his statement; also state if in your judgment he would be able to perform the duties of_____ for which position he is an applicant.

Kindly inform me as to the cause of his leaving your service, noting your reply on the back hereof.

Any information given will be treated as strictly confidential.

Yours respectfully,

_____

It is the custom of all fidelity and surety companies as it is of all prudent employers of labor, to inquire carefully into the antecedents of those seeking employment. In no other way can they escape being made the unconscious and pitiful victims of designing adventurers. The above form is exceedingly brief and may be enlarged or modified to meet the particular views of the employer making the inquiry.

C. D. Form 46.

FORM OF BLANK USED BY SUPERINTENDENT OF CAR DEPARTMENT IN ADVISING FOREMEN AND OTHERS OF PERSONS ELIGIBLE FOR EMPLOYMENT.

_____ 19____

Mr._____

_____Foreman.

Dear Sir:—

The bearer_____has made application for position as_____. If you are in need of a man in this department of the service you may employ him, after satisfying yourself as to his ability and other needed qualities.

_____

_____

REPLY.

_____ 19____

Referring to the above, this is to certify that I have employed / not employed

_____ as _____

this day, and rated him at_____per hour.

_____

NOTE.—If the person was not employed return the form simply striking out the word "employed." If employed the form should be filled up striking out the words "not employed." If engaged in shop work give name and number of shop.

C. D. Form 47.

Master Car Builder's Defect Card.

The rules of the Master Car Builders (Superintendents of Car Department) require that the "Defect Card" (printed on heavy cardboard) shall be printed in red ink—on both sides—and the information written in on both sides of the card in ink or with indelible pencil. The card is issued by the company on whose line the car was damaged, and authorizes any company making the repairs to make a bill for such repairs against the company issuing the card. The card should specify in full each item for which a charge may be made, indicating the place on the car where defect exists. Under the Master Car Builders' regulations the ends of the car are designated as "A" and "B"; the "B" end being that upon which the brake staff is located; the opposite end being "A." In case there are two brake staffs on the same car the end toward which the cylinder push rod travels is known as the "B" end. The defect card must be securely attached to the car with four tacks and must be placed on the outside face of the intermediate sill between the cross tie timbers. In the event a defect card is detached or becomes illegible, it is understood that a duplicate will be forwarded upon application.

C. D. Form 47.

MASTER CAR BUILDER'S DEFECT CARD.

.....RAILWAY COMPANY.

Car No....., date,..... 19.....

Initials,.....line,.....

will be received at any point on this company's line with the following defects:

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Inspector at.....

Send bill for repairs account of this card to superintendent of car department of the company issuing same.

This stub is to be retained by the person issuing the card.

Date ..... 19.....

Initials .....

No. .....

DEFECTS.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Name .....

Inspector at .....

C. D. Form 48.

INSPECTOR'S MONTHLY REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF MASTER CAR BUILDERS' DEFECT CARDS ISSUED.

At_____ During the month of_____ 19____

NOTE.—This report is to be sent to the superintendent of car department on the first day of the month following that in which cards were issued.

Report of inspector					Leave these columns blank for use of superintendent of car department			
Date	Car			Defects	Bill rendered on account of defect			
	Initials	No.	Class		By what company	Date	No. of bill	Remarks

This report is necessary for the purpose of auditing bills rendered against the company on account of defect cards issued by it; also for supervisory purposes and to prevent duplication of charges.

C. D. Form 49.

REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF REPAIRS TO FOREIGN CARS ACCOUNT MASTER CAR BUILDERS' DEFECT CARDS.

Report of repairs made at.....Station. .....19.....

on.....car; Class.....; No.....; for which bill is to be rendered.

Authority for bill { M. C. B. Defect Card issued by.....at..... .....19....
Rule No..... .....Foreman.

NOTE.—The authority for making bill and all papers pertaining to same should be attached to this report and forwarded to the superintendent of car department the same day repairs are completed. In case wheels are changed, for which (under M. C. B. rules) bill is to be rendered, the report of wheels applied to foreign cars (C. D. 52) should accompany this report in order that bill may be made at once.

DESCRIPTION OF REPAIRS AND AMOUNT OF MATERIAL USED.

_____

_____

_____

_____

_____

_____

_____

_____

_____ Labor _____ hours.

Credits : _____

_____

_____

The information contained in this report forms the basis of the bill against the company responsible for the expenditure.

C. D. Form 50.

Master Car Builders' Repair Card.

When repairs are made to a foreign car this card (printed on heavy cardboard) is tacked to the outside of the intermediate sill between the cross tie timbers. It should specify the date, place, extent and reason for the repairs being made and by what company. The location of the repaired part should also be specified on the card. The stub should be sent to the Superintendent of Car Department for his use in making bill against the company responsible and it is to be attached by him to such bill. In those cases where no bill is to be rendered, the stub must be forwarded before the 20th of the succeeding month, with the words "No bill" written across its face. In case no charge is to be made for the repairs the words "No bill" should also be written across the face of the repair card.

The information (in each case the same) should be filled in on both sides of the card with ink or indelible pencil. In case of repair cards being lost or becoming illegible duplicate cards are furnished upon application.

When card is applied to car send this stub at once to superintendent of car department retaining the duplicate stub attached hereto.

MASTER CAR BUILDERS' REPAIR CARD STUB.

_____Ry. Date_____19___

REPAIRS MADE.

[NOTE.—The reason for the repairs is written on the reverse side of this stub.]

Repaired at_____Shop.

_____ Inspector.

Car No._____Initials_____

(OVER)

C. D Form 50.

MASTER CAR BUILDERS' REPAIR CARD.

_____Ry. Co. Date_____19___

REPAIRS MADE.	WHY MADE.

Repaired at_____Shop_____Inspector.

Car No._____ Initials_____

NOTE.—The back of this card is the same as the above.

C. D. Form 51.

STUB TO BE RETAINED BY MAKER OF REPORT.

Date_____19___

Train No. _____

Applied _____

Cause of removal_____

_____

_____

Car No._____

Initials_____

[In place of writing up the stub, a facsimile copy of bill may be secured by the use of a carbon.]

REPORT OF JOURNAL BEARINGS, AIR BRAKE HOSE, AND KNUCKLES APPLIED TO FOREIGN FREIGHT CARS BY TRAINMEN.

Place_____ Date_____19___

NOTE.—This report must be filled up—specifying the articles—by the conductor when journal bearings, air-brake hose, and knuckles for automatic couplers are applied to foreign cars. It must show the date; initials and number of cars; cause of removal, and in case of journal-bearings, the size of same. It must be forwarded by first mail to the division superintendent, who will in turn forward it to the superintendent of car department by whom bill is rendered against the owner of the car.

Applied _____

Cause of removal _____

Car No._____ Initials_____

_____

Conductor.

This form (specifying the articles applied) is used in place of the usual repair card. It is sent to the official, who keeps the record of material entrusted to the care of the conductor. After the articles have been credited by such official the report is sent to the superintendent of car department who makes the bill against the owner of the repaired car attaching the above report thereto.

C. D. Form 52.

FOREMAN'S REPORT (IN DUPLICATE) TO SUPERINTENDENT OF CAR DEPARTMENT OF PARTICULARS OF WHEELS REMOVED FROM AND APPLIED TO FOREIGN CARS.

Car wheels removed and applied at_____ Date_____ 19___

_____ Foreman.

NOTE.—This report is to be made in duplicate and sent with the repair card stub, form C. D. 50, to the superintendent of car department immediately upon wheels being applied to and removed from foreign cars.

WHEELS REMOVED								AXLE	
Date	CAR		Makers	Date cast	No. on wheel or axles	Cause of removal of wheels	Shop marks on wheels and axles	Condition	Size of Journal
	NO.	INITIALS							

WHEELS APPLIED								
Date	CAR		Makers	Date cast	No. on wheel or axle	New or second-hand	Shop marks on wheels and axle	REMARKS
	NO.	INITIALS						

As this report forms the basis of a charge against the foreign company for the repairs, all information appertaining thereto should be furnished. The bill against the foreign company is made by the superintendent of car department. He should attach thereto the original of the above report, retaining the duplicate for his own use. Carbon should be used to secure the duplicate.

BILL AGAINST INDIVIDUALS, FIRMS AND CORPORATIONS. C. D. Form 53.

Maker's No._____

To_____Railway Co., Dr.

For repairs to cars as per Master Car Builders' rules. For month of_____19____

NOTE.—If, upon examination, an error is found in the account, the papers are to be returned at once, to the maker, for correction.

REPAIRS MADE		CAR		DESCRIPTION OF PARTS REPAIRED	Value of miscellaneous materials		Cast	Wrought	Spring	Malleable	Lumber	Labor	CREDIT FOR SCRAP			
Date	Place	Initial	Number				Cast	Wrought	Spring	Malleable			Cast	Wrought	Spring	Malleable
							Lbs.	Lbs.	Lbs.	Lbs.	Feet	Hours	Lbs.	Lbs.	Lbs.	Lbs.
QUANTITY																
PRICE																
VALUE																

Total amount of bill		
Less am't for scrap		
NET CHARGE,	$	

I hereby certify that the above account is correct_____

Superintendent Car Department.

This form is used in making bills against individuals, firms and corporations, for repairs made to cars with which they are chargeable under M. C. B. rules. It is one of three forms made at one writing with use of carbons, viz.: the original, which is sent to the individual, firm or corporation against which bill is made; the duplicate, which is sent to headquarters for entry on the general books; the triplicate, which is retained for record in the office in which it is made.

C. D. Form 54.

JOINT EVIDENCE CARD.

.....Railway Co.

Report of improper repairs to.....cars.

Station..... Date.....19..

Car No.....initials.....received from .....R'y. at..... Date.....19..

Description of wrong repairs.....	How repairs should be made.....

We certify above to be correct { .....Inspector for.....R'y. / .....Inspector for.....R'y.

Show how carded on other side.

(The following is printed on back of above card:)

.....Railway Company.

M. C. B. DEFECT CARD. Issued by.....R'y., at..... Date..... 19..

Inspector.....Reading as follows.....

M. C. B. REPAIR CARD. Issued by..... R'y., at..... Date ....19..

Inspector..... Reading as follows.....

DISPOSITION OF CAR. Carded to.....shop; repaired; went forward without repairs.

When improper repairs have been made to a car by a foreign company, this card (printed on heavy card paper) is used to describe the location of the parts repaired or removed. It is sent to the company making the improper repairs and such company must furnish a defect card (form C. D. 47) covering the wrong repairs if made by it, as claimed. The joint evidence card is not to be used as authority for making a bill unless accompanied by a repair card (form C. D. 50) upon which a bill has been made. In the absence of a repair card, a joint evidence card is to be sent to the company against which evidence has been presented of improper repairs, and such company must furnish a defect card (form C. D. 47) covering the wrong repairs if made by it as claimed.

C. D. Form 55.

SHOP FOREMAN'S REPORT TO SUPERINTENDENT OF CAR DEPARTMENT OF PARTICULARS OF BRAKES, TRUCKS, ETC., UNDER PASSENGER CARS RECEIVING REPAIRS.

At_____ Date_____ 19__

NOTE.—This report must be sent to the superintendent of car department by the shop foreman and must include all cars passing through the shop. This for the purpose of determining whether any changes have been made in the equipment of the car while it has been in service, that have not been reported for record.

CAR NO.	WHEELS PER TRUCK	WHEEL BASE OF TRUCK	WHEELS		SIZE OF JOURNAL	NO. OF WHEELS BRAKED	BRAKE SYSTEM	SIZE OF CYLINDER	WEIGHT OF CAR	LEVERAGE	KIND OF BRAKE BEAM	SIZE OF U BOLT	KIND OF OIL BOX	NO. OF PEDESTAL
			KIND	SIZE										

The object of this report, as stated, is to insure an authentic record in the office of superintendent of car department.

C. D. Form 56.

RECORD OF SUPERINTENDENT OF CAR DEPARTMENT OF PASSENGER CARS.

Name or No. of car..... Class of car ..... Built or rebuilt..... 19.. By.....

Length over all.....
Width " " .....
Height " " .....
No. of wheels per truck..... Wheel base of truck.....
Kind of wheels..... Size of wheels.....
No. of windows..... Size of glass.....
Style of interior finish.....
Kind of heater .....
Illumination..... No. of lamps.....
General description of interior arrangements:.....

Length over sills.....
Width " " .....
Height from top of sills to bottom of plate.....
Total wheel base of car.....
Kind of coupler .....
No. of deck sash..... Size of glass.....
Seating capacity.....
Weight..... Leverage.....

IN SHOP		DESCRIPTION OF REPAIRS	WHEN PUT INTO SERVICE
Date	Shop		

This record book is written up in the office of the superintendent of car department, a separate page being kept for each car and all changes in the structure of the car duly recorded. When a car is in the shop for repairs, the date and name of the shop is shown; also a description of the repairs and date the car was returned to service.

C. D. Form 57.

RECORD OF SUPERINTENDENT OF CAR DEPARTMENT OF FREIGHT CARS.

Number of car	LENGTH	WIDTH	CAPACITY	WEIGHT	BUILT BY	When built	REMARKS
01							
03							
05							
07							
09							
11							
13							
15							
17							
19							
21							
23							
25							
And so on down to 100							

This record book is kept in the office of the superintendent of car department. In the column headed "Remarks" is entered information regarding special changes or repairs, such as repainting, relettering, etc. When the number of a car is changed to some other number, a notation to that effect is made opposite both the old and new numbers. The number of the page of the record book furnishes an index to the car number; thus if the car number is 60025, the book should be opened at page 600, and the number 25 will show the record of the car. Two books may be kept; one for odd numbers of cars and one for even numbers.

"A" C. D. Form 58 for Light repairs.
"B" C. D. Form 59 for Medium repairs.
"C" C. D. Form 60 for Heavy repairs.

INSPECTOR'S NOTICES TO BE ATTACHED TO CARS NEEDING REPAIRS.

A	Initial or line_____ Number_____ _____ _____ _____ _____ Repaired_____

NOTE.—There are three cards of this description printed on different colored cardboard, viz.: "A" on white paper; "B" on purple paper; "C" on yellow paper.

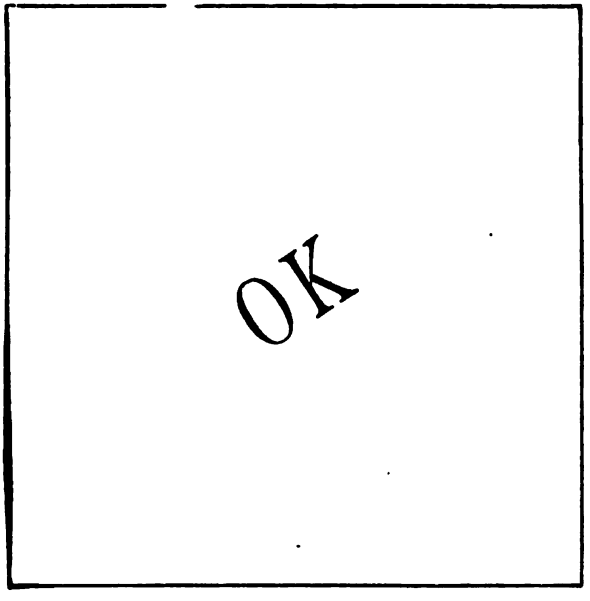
The A card is attached by inspectors to cars requiring Light repairs costing not more than $15.00.

The B card is attached by inspectors to cars requiring Medium repairs, ranging in amount from $15.00 to $40.00.

The C card is attached by inspectors to cars to be Rebuilt or requiring Heavy repairs, ranging in amount from $40.00 upwards.

C. D. Form 61

INSPECTOR'S "O. K." CARD INDICATING CARS READY FOR SERVICE.



This notice (printed on heavy cardboard) is attached to each end of every car in repair yard that has been repaired and is ready for service. It is commonly used only in wet weather, chalk being used at other times.

C. D. Form 62.

INSPECTOR'S CARD FOR FREIGHT CARS EQUIPPED WITH OIL HEATERS.

HEATED CAR.

(Printed in heavy red ink letters)

This car, Initial_____ Number_____ is supplied with oil heaters Nos._____ and_____. Attention must be given same by all parties handling car to see that temperatures are kept to right point and that there is no danger from fire.

(Printed in black ink.)

NOTE.—A card of the above form (printed on heavy cardboard) should be tacked to the door on each side of every car equipped with oil heaters. The heaters must be filled with kerosene oil and put in good condition before leaving loading points The reservoirs of heaters must be filled to within 2½ inches of the top. The heaters must not be allowed to remain in the cold after reaching destination without emptying the water which might otherwise freeze and damage the heater. The wicks must not be turned up too high, and the ratchet wheel must be well caught in the wick so that it will not be shaken down in transit. The traps in drain pipes of ice boxes must be opened or other means provided of giving the heaters a sufficient supply of fresh air. Heaters should be placed in cars and lighted at least one hour before leaving terminal. The oil reservoir when filled will burn from 16 to 24 hours. Kerosene oil only should be used. THIS CARD MUST BE REMOVED FROM CAR DOORS WHEN HEATERS ARE TAKEN OUT.

This card is fastened to the doors of cars in which there are oil heaters; this for the purpose of attracting the attention of those handling the cars as they are expected to see that the temperature is properly regulated.

C. D. Form 63.

INSPECTOR'S CARD FOR CARS LOADED WITH INFLAMMABLE MATERIAL.

HANDLE CAREFULLY

(Large type; red ink.)

THIS CAR IS LOADED WITH

INFLAMMABLE MATERIAL

(Large type; red ink.)

In case of leakage, report immediately to the station agent, and place car where it will not be exposed to fire or subject employes or others to danger.

Station..... Initial of car..... No. of car.....

Date..... .....Foreman.

NOTE.—It is the duty of the inspector in charge of yards where oil tank cars and other cars containing oil, are received, to securely attach one of these cards (printed on heavy green cardboard) on each side of the car on some part of the side sill, or other conspicuous place where it can be easily seen, so that it may serve as a warning to trainmen in handling the car. Care must be exercised in the inspection of such cars; particularly when found to be in a leaky condition. In the latter case the car must be at once reported to the agent in charge of the station, so that he may take such action as is best in disposing of the load. Care must also be exercised in the use of lights about these cars. Every effort to facilitate the movement of such cars must be taken on the part of the car department; nor must it lose time in reporting the condition of the car and in making needed repairs when possible. If unable to make repairs the fact should be reported to the proper official, that advice and assistance may be rendered.

HOME ROUTE CARD. C. D. Form 98.

FROM

_____ R. R.

TO

_____ R. R.

VIA

_____

Car No._____ Initials_____

To be shopped for_____

_____

_____

_____

_____

Superintendent Car Department.

Whenever a foreign car is unsafe to load—due to age or decay—the owner must be advised at once. If he wishes it sent home, he must furnish two home route cards (printed on heavy white cardboard and duly signed) of this form. He must note thereon the defects of the car and the route over which it should be returned home. These cards should be attached to each side of the body of the car. The cards are printed alike on both their sides and are written up with ink or indelible pencil.

C. D. Form 65.

PENALTY CARD.

SPECIAL HOME ROUTE CARD.

Home route via _____ R. R.

at _____

To avoid PENALTY

this car must be given movement to above junction point in preference over everything except time freight and live stock, and delivery must be made to home road or connecting line on or before

_____ 19___

(Printed on red cardboard in conspicuous type.)

A foreign car may be used by a company under the per diem system for the agreed number of days for the minimum charge (say 20c per day). If the car is kept by the company more than the stipulated number of days a penalty charge per day (in addition to the per diem rate) is charged for every day that the car is thus held. A penalty notice is sent by the company owning the car to the company on whose line the car is retained (after the car has been on such line twenty consecutive days), giving the date when the holding company will be penalized. On receipt of such notice the agent at the station at or near which the car is located is promptly notified in order that he may start it at once on its way home after attaching the penalty card described above.

C. D. Form 8b.

REPORT OF INSPECTION OF CARS AFTER AN ACCIDENT TO EMPLOYES OR OTHERS.

This form is used to report the details of accidents when persons are killed or injured by, or around cars. It is designed to enlighten the officers of the company as to whether the accident was occasioned by defective condition of the equipment or otherwise. (Carbons may be used in making the copies.)

Where inspected..... Date.....19....
Initials, numbers and class of cars inspected.....
.....
Name of person injured or killed*.....
Nature of accident .....
Location and date of accident.....

INSTRUCTIONS.—If persons are injured or killed while coupling or uncoupling cars, or in any other way when the accident may have been caused by defective condition of the equipment, the cars must be immediately examined, to ascertain their condition. Report must be made of the inspection, giving all information regarding condition of the cars that will throw any light on the cause of and responsibility for the accident. This examination should be made by the inspector or car foreman (or such other employe as may be designated by the proper official), assisted by at least two other employes as witnesses, who must also sign the report. This report should be made in triplicate, immediately after examination of cars, and a copy sent by first mail to the general claim agent, division superintendent, and superintendent of car department, respectively.

COUPLERS.

Kind on each car?.....
Height from top of rail to center of draft line?.....
In what condition?.....
If in bad order, how marked and where?.....
Were cars equipped with castings or buffers at either side of couplers?.....
Were knuckles, chains, pins and clevis in good order? .....

BRAKES.

Kind on each car?.....
In what condition?.....
If broken, how caused?.....

LADDERS.

On sides or ends of cars?.....
In what condition?.....

GRAB IRONS.

Location on cars?.....
Height from floor of cars?.....
In what condition?.....

RUNNING BOARDS.

In what condition?.....

MISCELLANEOUS.

Were there any platforms on cars?.....
Were cars loaded or empty?.....
What repairs have been made to cars since accident?.....
Remarks (give here any general information regarding the condition of the cars not included in the above) .....
.....
.....
.....

Signature of person making inspection.....
Occupation.....

We, the undersigned, were present and helped make the above examination and hereby certify that the facts as stated by..... in above report are true.

Signature of witness.....
Signature of witness.....

* Strike out "killed" or "injured," as the case may be, if the accident does not cover both classes.

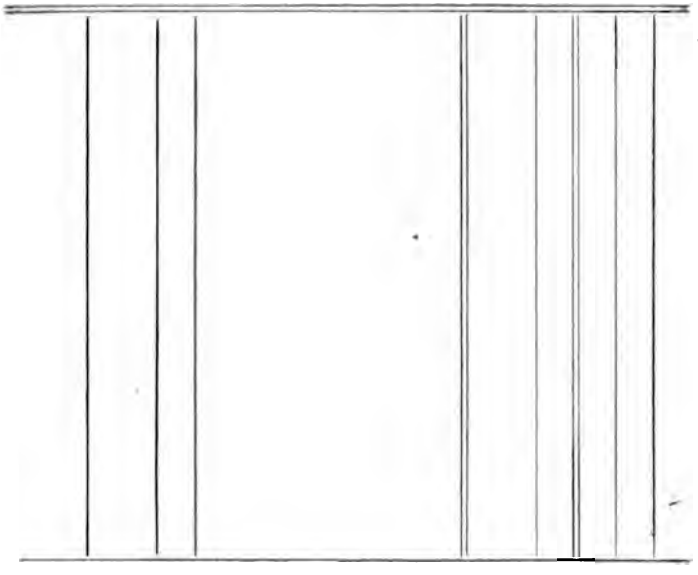
C. D. Form 67.

DISTRIBUTION BLANK FOR MATERIAL USED.

_____Office, _____Division. Folio_____

DISTRIBUTION OF MATERIAL, for the month of_____19___

Chargeable to "*Repairs of Passenger Cars*" (to illustrate).



This form is used by storekeepers and other officials and employes who have charge of material and are required to make return thereof for purposes of accounting and otherwise. A separate heading ("Chargeable to") is opened with each account on which material has been expended so far as the same is required to be specifically stated by the regulations of the service. The blanks are furnished in loose (detached) sheets so that the person who writes them up may take an impression (or carbon) copy before they leave his hands; this in order to save the clerical work that would otherwise be required in making a written copy. The impression is retained for local use and the original sent to headquarters.

The sheets are eyeletted so as to enable the person making the return to collect them together (in due order) and bind them in book form before they leave his hands. Covers (similarly eyeletted) for the books thus formed are furnished with the blanks. The recapitulation of the accounts charged (to be given in the back part of the book) must be signed by the storekeeper or official making the return.

C. D. Form 68.

DISTRIBUTION BLANK FOR LABOR PERFORMED.

_____Office, _____Division. Folio_____

DISTRIBUTION OF LABOR, for the month of_____19____

Chargeable to "*Repairs of Freight Cars*" (to illustrate).

	NAME	KIND OF SERVICE	Folio of time book	Time worked	RATE	Detailed Amount		Total Amount		

Blanks of this form are used by storekeepers and other accountants who are required to render returns for labor. A separate heading (*i. e.*, the name of the general account) is opened with each account on which labor has been expended so far as the same is required to be specifically stated by the regulations of the service. The blanks are furnished in loose (detached) sheets so that the person who writes them up may take an impression (or carbon) copy before they leave his hands; this in order to save the clerical work that would otherwise be required in making a written copy. The impression is retained for local use and the original sent to headquarters. The sheets are eyeletted so as to enable the person making the return to collect them together (in due order) and bind them in book form before they leave his hands. Covers (similarly eyeletted) for the books thus formed, are furnished with the blanks. The recapitulation of the accounts charged (to be given in the back part of the book) must be signed by the accountant or storekeeper making the return.

INDEX.

Explanatory Note: This volume is divided into two books, viz.: Book I, "The Railway Car, Its Construction and Handling," and Book II, "The Car Service Department." The reader will note that following each subject is the Roman numeral I or II; these numerals refer to the book in this volume to which reference is made. Thus:

Air Brake—Box Car..... I 150
means that that item will be found on page 150 of Book I, "The Railway Car, Its Construction and Handling," of this volume, and
Auditor of Car Accounts..... II 99
means that the latter item will be found on page 99 of Book II, "The Car Service Department," of this volume.
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